Integrating Novell® Open Enterprise Server for Linux

COURSE 3077

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Introduction

The *Integrating Novell Open Enterprise for Linux* course (3077) helps you learn how to implement infrastructure services (such as DNS and DHCP) and Novell Open Enterprise Server (OES) services (such as iPrint and iFolder) on an OES Linux server by migrating data and services from an existing Novell NetWare 6.5 server, or by installing the services directly on the OES Linux server.

Before starting the course, make sure you review the following:

- Student Kit Deliverables
- Course Design
  - Course Objectives
  - Course Audience
  - Prerequisite Knowledge
  - Novell Open Enterprise Server Training Path
  - Classroom Agenda
  - Course Setup
- Exercise Guidelines
  - VMware and the Exercises
  - Exercise Conventions
  - Self-Study Setup
  - Novell Open Enterprise Server Product Documentation
  - Web Browser Tools and Applications
  - Scenario
- Course Feedback

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Student Kit Deliverables

Your kit for the *Integrating Novell Open Enterprise for Linux* course contains the following:

- **Integrating Novell Open Enterprise Server for Linux Authorized Courseware (Volumes 1 and 2).** This is the printed course manual that contains instructional and reference content.
- **Integrating Novell Open Enterprise Server for Linux Workbook.** This is the printed manual that contains exercises and instructions for setting up a self-study environment.
- **3077 Course CD.** This CD contains the course manual in PDF format, the workbook in PDF format, and a readme file.

  In addition, there are several folders with the following content:
  - **exercises.** This folder contains files used for the course exercises.
  - **OES_docs.** This folder contains all of the Novell OES documentation referenced in the course manual.
  - **setup.** This folder contains all the files you need (except for the VMware virtual servers) to set up the exercise environment.
- **3077 VMware Servers DVD.** This DVD contains the DA1 Linux server and the DA2 NetWare server used in the course exercises.
- **3077 VMware SLED 10 Workstation DVD.** This DVD contains the SUSE Linux Enterprise Desktop 10 workstation used in the course exercises.
- **Novell OES SP2 CDs.** You use these CDs in the course exercises to upgrade to Novell Open Enterprise Server (OES) or to install Novell OES services.

  They include the following:
  - Novell OES SP2 NetWare Installation CD 1
  - Novell OES SP2 NetWare Installation CD 2
  - Novell OES SP2 Linux Installation CD 1

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- Novell OES SP2 Linux Installation CD 2
- Novell OES SP2 Linux Installation CD 3
- Novell OES SP2 Linux Installation CD 7
- Novell OES SP2 Linux Installation CD 8

Course Design

The following provides information about the design of the course to help you evaluate whether or not this course provides the type of Novell OES training you need (in a classroom environment or for self-study):

- Course Objectives
- Course Audience
- Prerequisite Knowledge
- Certification
- Novell Open Enterprise Server Training Path
- Classroom Agenda

Course Objectives

The overall objective of this course is to prepare you to install or migrate a Novell OES service in a limited, non-critical production environment with few changes to the default settings by teaching you how to do the following:

- Evaluate the value of a Novell OES service to your customers and employees.
- Evaluate the hardware and software requirements necessary to implement a Novell Open Enterprise Service service.
- Use your current Novell networking skills and experience to perform Novell OES administrative tasks on an OES Linux server.

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- Perform basic administrative tasks on an OES Linux server using tools such as the Bash shell and YaST that are native to SUSE Linux Enterprise Server.
- Use Novell OES tools such as OpenSSH, iMonitor, iManager, and Novell Remote Manager to manage Novell OES servers in a mixed OES NetWare and OES Linux network environment.
- Implement DNS and DHCP on an OES Linux server.
- Configure time synchronization in a mixed OES NetWare and OES Linux network environment.
- Migrate Novell Storage Services (NSS) data and NCP from a NetWare server to an OES Linux server with little or no impact on user access.
- Provide access to data on an OES Linux server from a Windows workstation using the CIFS/Samba protocol.
- Migrate iPrint services on a NetWare server to an OES Linux server with little or no impact on printer access.
- Install the latest version of iFolder (3.2) on an OES Linux server.
- Implement other Novell OES end user services such as eGuide and NetStorage.

The *Integrating Novell Open Enterprise for Linux* course also helps to prepare you for the available Advanced Technical Training (ATT) Novell OES courses. We recommend that you become familiar with the content of this course before attending a Novell OES ATT course.

Course Audience

We expect the audience for this course to include

- Novell software system administrators, integrators, and engineers
- Networking consultants

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- Reseller/partner technical support staff
- New Novell OES customers

The ***primary target audience*** for the *Integrating Novell Open Enterprise Server for Linux* course is established Novell NetWare administrators who need to evaluate Novell OES services running on an OES Linux server or who administer or implement OES services on an OES Linux server.

If you fit this audience, we expect that you are already familiar with using Novell eDirectory and related tools such as iManager. However, you might have little or no experience using Linux.

If you have little or no Linux experience, the exercises in the workbook give explicit instructions for dealing with the OES Linux operating system.

However, to adequately manage OES services running on an OES Linux platform in a production environment, you should have the minimum of a CLP (Certified Linux Professional) certification-equivalent knowledge of SUSE Linux Enterprise Server.

A ***secondary target audience*** for the *Integrating Novell Open Enterprise Server for Linux* course is a new Novell customer who is assigned to evaluate, administer, or implement enterprise services on an OES Linux server.

If you fit this audience description, you might be a Windows or Linux network administrator unfamiliar with eDirectory or OES services but with experience administering infrastructure services (such as DNS and DHCP) on a Windows or Linux server.

If you have little or no eDirectory experience, an introduction to eDirectory is provided in an eDirectory Fundamentals appendix in the *Integrating Novell Open Enterprise Server for Linux* course manual.

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However, the appendix and the course exercises do not give you adequate experience or training to perform eDirectory administrative tasks such as troubleshooting.

Prerequisite Knowledge

Before you start this course, we recommend that you have an understanding of the following:

- CompTIA A+ objectives
- CompTIA Network+ objectives
- Fundamentals of Novell eDirectory (Course 3017) objectives

  or

- Equivalent networking and eDirectory experience (on NetWare, Linux, or Windows)

We also recommend (but do not require) the following:

- Some experience with eDirectory 8.7.3 or later through training, testing, or on-the-job experience
- Basic experience with any Linux desktop or server in a computing environment such as an enterprise or academic environment or through a training course (such as 3071 - SUSE Linux Enterprise Server 10 Fundamentals)

You do not need to have an extensive knowledge of Linux to successfully complete the exercises in the course.

However, you do need to remember that to adequately administer Novell OES services on an OES Linux server in a production environment, you need to have a Certified Linux Professional (CLP) certification-equivalent knowledge of SUSE Linux Enterprise Server 9 or 10.

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Certification

This course helps you prepare for the following tests:

Table Intro-1

Certification	CNE Test Number	CNI Test Number
CNE	050-700	050-900

Arrange to take a test within 6 weeks of receiving this course. After that, the test might be replaced by a test based on an updated version of the course.

For more about Novell certification programs, access www.novell.com/training/certinfo/.

Novell Open Enterprise Server Training Path

The *Integrating Novell Open Enterprise Server for Linux* course is part of a larger training path that includes additional learning experiences for those that need to design or implement a Novell OES solution.

For details on additional Novell OES training opportunities provided by Novell Global Training Services, see http://www.novell.com/training/bytopic/oes.html.

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Classroom Agenda

This course is designed to be taught as a 5-day course with the following basic agenda:

Table Intro-2

	Module	Duration (hh:mm)
Day 1	**Introduction**	00:30
	Section 1: Evaluate and Upgrade to Novell Open Enterprise Sever	03:00
	Section 2: Manage an OES Linux Server	03:30
Day 2	**Section 3:** Manage Novell OES Servers	03:00
	Section 4: Implement DNS/DHCP on an OES Linux Server	02:00
	Section 5: Migrate NSS Volumes to an OES Linux Server	01:30
Day 3	**Section 5:** Migrate NSS Volumes to an OES Linux Server (*continued*)	03:00
	Section 6: Access Data on an OES Linux Server Using CIFS/Samba	02:00
Day 4	**Section 7:** Migrate the iPrint Service to an OES Linux Server	02:30
	Section 8: Install and Configure iFolder on an OES Linux Server	03:30
Day 5	**Section 9:** Configure White Pages (eGuide)	01:30
	Section 10: Provide File Access with NetStorage	01:30
	Section 11: Plan a Novell OES Implementation	01:00

If you have purchased this course as a self-study kit, you can expect to spend 3-4 hours setting up the practice environment, and spend 14 hours (or more) working through the exercises.

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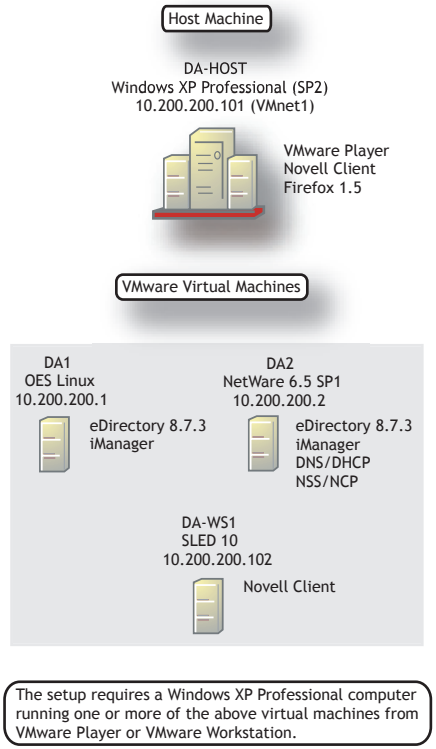
Course Setup

The following is the Windows XP Professional host machine and the VMware virtual machines used for the exercises in the course.

Figure Intro-1



The setup requires a Windows XP Professional computer running one or more of the above virtual machines from VMware Player or VMware Workstation.

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Exercise Guidelines

The following information provides guidelines to help you make the most of the exercises provided in the course:

- VMware and the Exercises
- Exercise Conventions
- Self-Study Setup
- Novell Open Enterprise Server Product Documentation
- Web Browser Tools and Applications
- Scenario

VMware and the Exercises

VMware Workstation software lets you create and run multiple x86 virtual computers on a single physical computer simultaneously. Each virtual machine can start and run its own guest operating system, such as NetWare, Windows, and Linux.

VMware Player, free virtual-machine software, can run virtual machines made by other VMware products, but you cannot use it to create new virtual machines.

This course provides several VMware virtual machines that you run on a Windows XP Professional physical computer.

To complete the exercises in the course, you can use VMware Workstation or VMware Player. In a classroom setting, you might be using one or the other.

The following guidelines help you have a successful experience using VMware for the course exercises:

- How to Move In and Out of VMware
- How to Use the VMware Snapshot Feature
- How to Use VMware Player

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How to Move In and Out of VMware

While using a VMware virtual machine, you can switch (release) mouse and keyboard control to the host computer desktop by pressing **Ctrl+Shift+Alt**.

To return mouse and keyboard control to the VMware virtual machine, press **Ctrl+G** or select the VMware window.

Pressing **Ctrl+Alt+Insert** in a VMWare virtual machine is the same as pressing Ctrl+Alt+Delete.

How to Use the VMware Snapshot Feature

If you are using VMware Workstation 5.*x* to run the virtual machines on the Windows XP Professional host computer, you can use the Snapshot feature to capture the current state of a virtual machine hard drive as a file, and then return to that state by selecting the Snapshot file.

Because Snapshot only saves the difference between the last state of the hard drive and the current state, snapshot files are relatively small.

The Snapshot feature is very useful when completing exercises. After successfully completing an exercise, you take a snapshot of the current state of the virtual machine. If you have problems in the next exercise, you can start over by reverting back to the previous snapshot.

To use the Snapshot feature in this course for exercises, you need to know how to do the following:

- Capture an Exercise Snapshot
- Return to a Previous Exercise Snapshot

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If an exercise involves using more than one virtual machine (such as DA1-LINUX, DA2-NETWARE, and DA-WS1-SLED), make sure you take a snapshot of each at the end of the exercise.

If you are in a classroom setting, the instructor might have already provided exercise snapshots on your DA-HOST Windows XP Professional workstation.

Capture an Exercise Snapshot

To capture a snapshot of a virtual machine at the end of an exercise, do the following:

1. Make sure that your mouse cursor is released from the virtual machine window (you normally press **Ctrl+Shift+Alt**) and that you have shut down the virtual machine.

   Shutting down the virtual machine before capturing saves space because VMware only captures the current state of the virtual hard drive (.vmdk file) instead of the hard drive and what is in memory.

   Shutting down the virtual machine before capturing also ensures a clean snapshot and can help you avoid problems with some systems that can occur after the snapshot such as decreased processing speed.

2. From the VMware Workstation menu bar, select **VM > Snapshot > Take Snapshot**.

   A Take Snapshot dialog appears.

3. In the Name field, enter the ***snapshot name***.

   We recommend using the name of the next exercise.

   For example, if you have just finished Exercise 1-1 successfully, use an **Ex. 1-2** snapshot name.

   This makes it easier to find the snapshot you need to start the exercise.

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4. In the Description field, enter a ***description*** of the virtual machine (such as **Use this virtual machine at the beginning of Exercise 1-2**).
5. When you finish, select **OK**.

   The snapshot file is saved in the same directory where your VMware virtual machine files are stored.

Return to a Previous Exercise Snapshot

To return the virtual machine back to a state at the end of a previous exercise, do the following:

1. Make sure that the VMware virtual machine is running or that the VMware virtual machine tab page is displayed.
2. Make sure that your mouse cursor is released from the virtual machine window (you normally press **Ctrl+Shift+Alt**).
3. From the VMware Workstation menu bar, select **VM > Snapshot > Snapshot Manager**.

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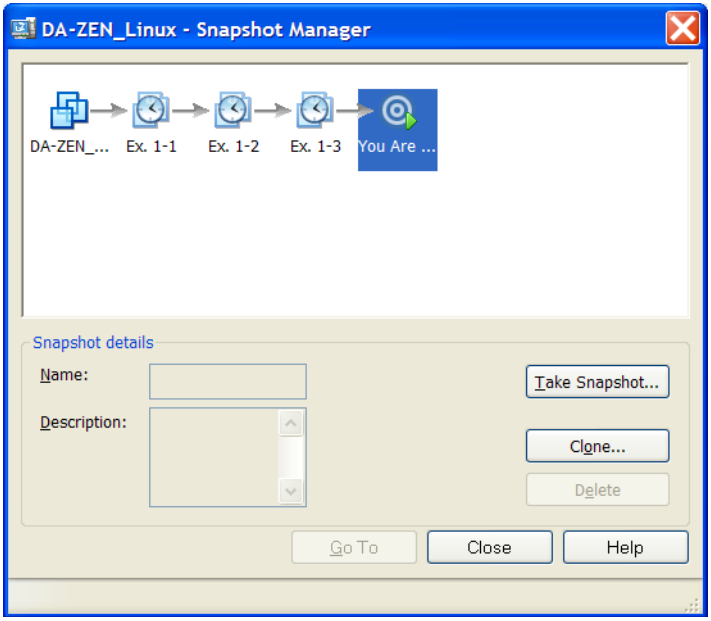
The Snapshot Manager dialog appears:

Figure Intro-2



The snapshot tree at the top of the dialog shows the snapshots for this virtual machine in the order you have taken them.

4. Select the ***snapshot*** for the exercise you want to start.

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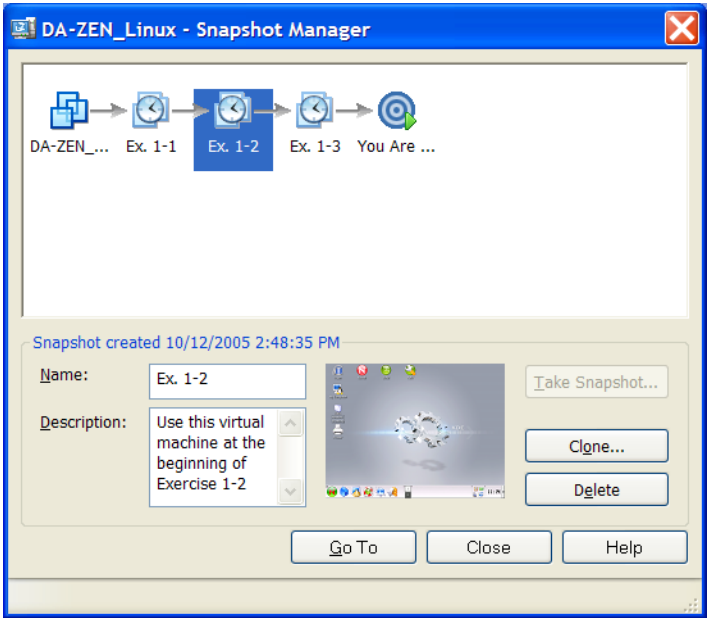
For example, if you wanted to start at the beginning of Exercise 1-2, you would select that snapshot:

Figure Intro-3



Notice that the full name and description of the snapshot appears below the snapshot tree window.

5. After selecting the snapshot, select **Go To**.

   A warning message appears indicating that the current state of the virtual machine will be lost if you restore the snapshot.

6. Do one of the following:

   - If saving the current state does not matter, continue by selecting **Yes**.

     or

   - If you want to save the current state before reverting to the selected snapshot, select **No**; then select **You are here** (in the snapshot tree) and save the state as a snapshot by selecting **Take Snapshot**.

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If you select Yes, the snapshot you selected is restored, and you can continue with the current exercise.

How to Use VMware Player

VMware Player is free, downloadable software from VMware that lets you play VMware virtual machines created in VMware Workstation. It is also available on your *3077 Course CD*.

This can be useful if you already have a VMware virtual machine, but do not own a copy of VMware Workstation.

Although you can install VMware Player on your DA-HOST Windows XP Professional workstation to run the course virtual machines, there are some issues you need to understand before using VMware Player to complete the exercises:

- **VMware Player and VMware Workstation Installations.** You cannot install VMware Player and VMware Workstation on the same computer.

  If you have VMware Workstation 5.*x* available, we recommend installing and using it on the DA-HOST Windows XP Professional workstation.

  Using VMware Workstation lets you open several VMware virtual machines in the same window, switching between machines by selecting tabs. You can also snapshot at critical points while performing the course exercises.

  If you have an earlier version of VMware Workstation, you will need to install and use VMware Player because the virtual machines can only run under VMware Workstation 5.*x*.

- **Tabs vs. Windows.** While you can run several virtual machines at a time using VMware Player, each machine needs to be opened in a different window.

  However, VMware Workstation lets you open several virtual machines in the VMware Workstation window, and then tab from machine to machine.

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While this does not impact the functionality of the exercises, the exercises are written with instructions for starting a virtual machine in VMware Player.

To start a virtual machine in VMware Workstation, you need to open (**File > Open**) the associated VMware Workstation (such as **NetWare 6.vmx** for the DA2-NETWARE server).

After opening the virtual machine, a tab (such as **DA1-LINUX**) appears in the VMware Workstation window. Make sure the tab is selected; then, under the Commands heading, select **Start this virtual machine**.

- **NetWare and VMware Player.** When you use the **down** command in NetWare to shut down the NetWare operating system, you might be left at a DOS prompt with the VMware Player window still open.

  At this point, you need to select **Player > Exit** from the top of the VMware Player window to close the DA2-NETWARE virtual server window.

  The next time you start the DA2-NETWARE virtual server, VMware Player takes a moment to load the server, and you are returned to the DOS prompt to start the DA2-NETWARE server by entering **server**.

- **Server shutdown in VMware Player.** When running a virtual machine from VMware Player, you can select **Player > Exit** at any time, and VMware will save the current state of the virtual machine in a special file.

  The next time you start the virtual machine, VMware restores the previous state of the server.

  For example, if you exit with a server desktop displayed, the next time you start the virtual machine, you are returned to the server desktop (without booting the server).

  While this feature has been used during our beta test of the exercises (with success), after starting the VMware virtual machine, you might need to wait a few minutes after the virtual machine is restored before all services are running again.

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Exercise Conventions

The exercises use conventions that indicate information you need to enter that is specific to your server.

The following describes the most common conventions:

- ***italicized/bolded text***. This is a reference to your unique situation, such as the host name of your server.

  For example, if the host name of your server is DA3 and you see the following:

  ***hostname*.da.com**

  you would enter

  DA3.da.com

- **10.200.200.*x* or DA*x***. This is the IP address or host name that is assigned to your OES NetWare server.

  For example, if your IP address is 10.200.200.3, and you see the following:

  10.200.200.*x*

  you would enter

  10.200.200.3

- **Select.** The word *select* is used in exercise steps to indicate a variety of actions, including clicking a button on the interface and selecting a menu item.

- **Enter and Type.** The words *enter* and *type* have distinct meanings.

  The word *enter* means to type text in a field or type text at a command line prompt and press the Enter key. The word *type* means to type text without pressing the Enter key.

  If you are directed to type a value, make sure you do not press the Enter key or you might activate a process that you are not ready to start.

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Self-Study Setup

If you plan on working through the exercises outside a classroom, the *Integrating Novell Open Enterprise Server for Linux Workbook* provides all the exercises in the course, as well as instructions for setting up the Windows XP Professional host computer and the VMware virtual machines you need to complete the exercises.

Novell Open Enterprise Server Product Documentation

For your convenience, we have provided many of the Novell OES administration guides available at http://www.novell.com/documentation/oes on your *3077 Course CD*.

These guides provide you with the instructions you need for implementing Novell OES (and related services and components) in a production environment, and are frequently referenced throughout this manual.

Web Browser Tools and Applications

As a general rule, Novell Open Enterprise server management tools (such as iManager and iMonitor) support the following browsers:

- Mozilla FireFox
- Mozilla 1.7.7 or later
- Internet Explorer 6 or later

In this course, you use the FireFox web browser in the course exercises because it runs on both Windows and Linux platforms.

When using Mozilla or Mozilla Firefox, tabs are handled by the browser as drop-down list options instead of the graphical tabs that appear in Internet Explorer.

However, the names of the drop-down list options and the graphical tabs are the same.

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Scenario

The following scenario is used throughout the course to help focus exercises on specific Novell OES administrative tasks:

“Digital Airlines management has made the decision to upgrade to Novell OES, keeping some services on NetWare and implementing others on OES Linux. They are also looking at adding services such as iFolder.

“As the NetWare administrator for Digital Airlines, you have requested hardware to test Novell OES services in a lab environment before implementing the product in a production environment.

“You decide to initially set up 2 test servers (one for OES NetWare and one for OES Linux) to test issues such as interoperability, management tools, and service performance.

“You decide to set up the following 2 servers to replicate the production environment:

- **DA2-NETWARE.** A NetWare 6.5 SP1 server that lets you test migrating existing services from NetWare to OES Linux.
- **DA1-LINUX.** A Novell Open Enterprise Server 9 Linux server which you use as the target server for migrating services, and for installing and testing new services.

In addition, you decide to manage and test OES services by using the following:

- **DA-HOST.** A Windows XP Professional workstation for use as an administrative workstation and to test use of a Windows desktop in the Digital Airlines environment.
- **DA-WS1-SLED.** A SUSE Linux Enterprise Desktop 10 workstation for testing use of a Linux desktop in the Digital Airlines environment.

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"After testing the current business requirements, management would like you to report the results and make recommendations, including any adjustments necessary to the way employee data and resources are currently accessed."

Course Feedback

Your feedback is valuable to Novell Education. To provide feedback on the course materials, use the web services tool at http://www.novell.com/training/contactus.html.

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SECTION 1 Evaluate and Upgrade to Novell Open Enterprise Server

In this section, you review Novell Open Enterprise Server (OES) features, components, and requirements to help you evaluate which features and services to use in your production environment.

You also learn how to plan an installation, consider the purchase and licensing options, and upgrade a Novell NetWare 6.5 server to a Novell OES NetWare server.

Objectives

1. Describe Novell Open Enterprise Server (OES)
2. Decide Which OES Services to Install
3. Plan Your OES Implementation
4. Purchase and License Novell OES
5. Upgrade to Novell OES NetWare

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Introduction

The process of migrating to Novell Open Enterprise Server (OES) involves more than just knowing how to upgrade existing software or how to install and use the services included in Novell OES.

A migration to Novell OES gives you the opportunity to re-evaluate your current network services and servers, considering options such as a move to an open-source platform (Linux), consolidating services, upgrading services, and integrating NetWare and Linux in the same environment.

In this section, you have the opportunity to evaluate Novell OES and make some initial decisions about purchasing and integrating Novell OES into your network environment.

You also learn how to upgrade an existing NetWare 6.5 server to an OES NetWare server.

For complete details on planning a Novell OES migration, refer to the *Novell OES SP2 Planning and Implementation Guide* (implgde.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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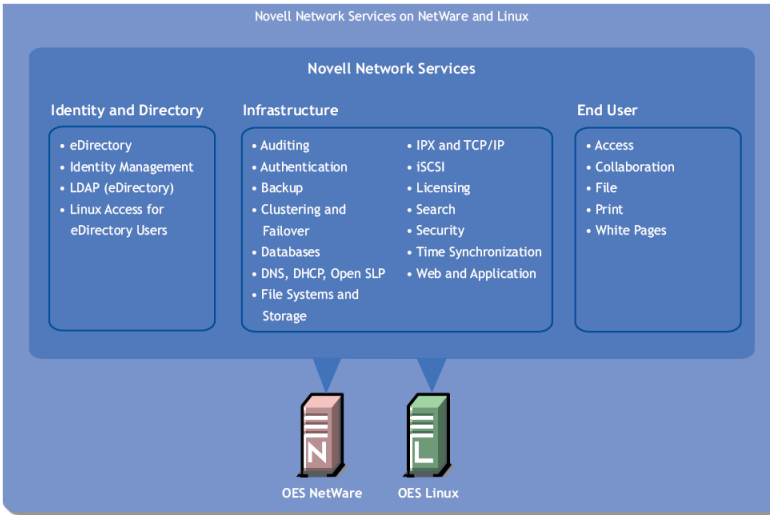
Objective 1 Describe Novell Open Enterprise Server (OES)

Novell Open Enterprise Server (OES) is a powerful combination of products and technologies that run on both the NetWare and SUSE Linux Enterprise Server (SLES) 9 operating systems.

Its series of services—application, file and storage, high-availability, management, networking and security—give you a choice of the platform to use (NetWare or Linux) to run all the available services:

Figure 1-1



You can deploy OES services on either an OES NetWare® server (NetWare 6.5 SP3 or later) or a SUSE® Linux Enterprise Server 9 (SLES 9) server.

You can choose to install OES on a new server or upgrade an existing NetWare 6.5 or SLES 9 server to run OES services.

The OES install automatically upgrades NetWare 6.5 with Support Pack 4 and SLES 9 with Support Pack 2 if the Support Packs were not previously installed.

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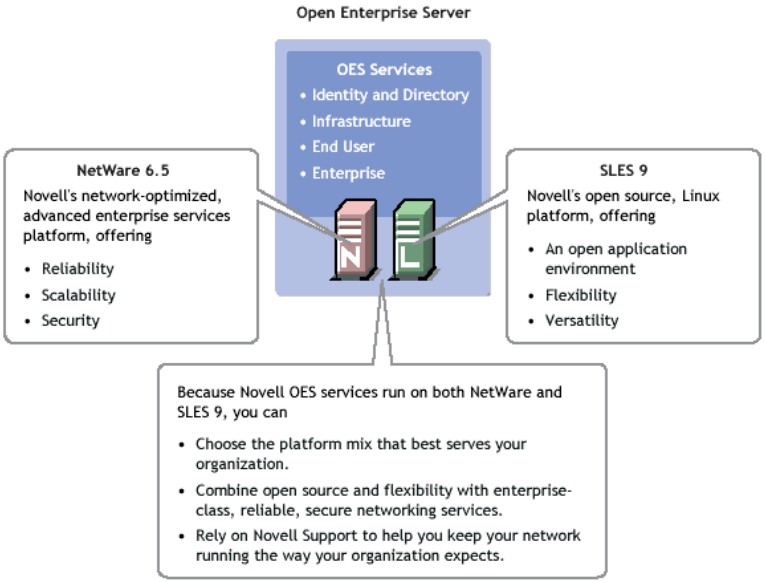
As indicated in the following, each platform (OES NetWare and OES Linux) offers unique strengths when providing network services:

Figure 1-2



To evaluate Novell Open Enterprise Server (OES), you need to know the following:

- Why Upgrade to Novell OES
- Novell OES Features

There is no direct upgrade path from Novell Nterprise Services 1.0 to Novell Open Enterprise Services.

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Why Upgrade to Novell OES

When considering an upgrade to Novell OES, you might have questions such as the following:

- How can we maintain the same level of service our NetWare services provide today?
- How can we get more out of Linux if our internal Linux skills are lacking?
- How can we move to Linux without disrupting our end users?
- How can we move to Linux without overhauling our IT department?

Keep in mind that you can

- Add Linux to your environment in a non-disruptive way
- Maximize hardware investments without replacing existing software
- Reinvigorate your IT staff and attract new IT talent
- Protect your NetWare investment by gaining access to new applications on Linux

In addition, deploying Novell OES enables you to do the following:

- Extend the Use of Novell Networking Services
- Add Linux from a Trusted Vendor
- Lower Management Costs via Coexistence
- Reduce the Number of Supported Operating Systems

For additional information, see the *Upgrading Your Business to Novell Open Enterprise Server* upgrade guide (upgrade_guide.pdf).

You can access the guide from http://www.novell.com/collateral/4821012/4821012.pdf or from the OES_Docs directory on your *3077 Course CD*.

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Extend the Use of Novell Networking Services

Investing in NetWare has always meant more reliability with fewer support issues, support for open standards, more performance from less hardware, upgrades that can be added at your convenience, and fair licensing practices so you retain ownership of what you buy.

Features like iFolder, iPrint, NSS, and clustering are only a few of the services that have convinced many to choose NetWare as their server platform.

Novell OES extends the life of your NetWare installations and lets you get the most out of your investment. You can use OES to introduce Linux and new services into your networking environment without having to rip-and-replace.

Add Linux from a Trusted Vendor

A benefit of Novell OES for NetWare customers is the opportunity to add an enterprise-class Linux operating system that provides value for any workload.

The Linux platform is continuously being improved by an entire community of open source developers. Linux is secure, not prone to hacking and viruses, and runs efficiently on commodity hardware.

Application and hardware support for Linux is always growing. Hardware vendors like Dell, Hewlett-Packard, and IBM have strong commitments to support the growth of Linux in the enterprise.

Application support allows Linux to moderate what has been viewed as a deficiency in NetWare. Leading commercial software vendors are now supporting Linux as a standard operating system.

The Novell Linux operating system provides robust, uniform Linux that can be used for several enterprise workloads, including Web infrastructure, networking, high-performance computing, and application hosting.

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And trusted services and support from Novell are available on Novell Linux to make sure your Novell OES investment is a sound, profitable decision.

Novell provides Novell OES support for companies of all sizes. This support is provided through training and certification, consulting, continuing education, 24x7x365 technical support, hardware and software partnerships, engineering expertise, and a worldwide channel of solution partners.

Lower Management Costs via Coexistence

Novell OES helps you to manage a mixed environment through support for multiple scripting languages.

Most IT developers write shell or perl scripts to perform actions against a large number of heterogeneous platforms. Novell OES makes it possible to write BASH or Perl scripts that can be used on either the NetWare or Linux platforms.

This reduces the number of scripts to be written and lets you see the mixed environment as a more homogeneous network.

In addition, tools such as eDirectory, NSS, and iManager, make managing Linux servers as easy and familiar as managing NetWare. You can run your existing services in parallel on both platforms without having to migrate abruptly.

With Novell OES, you can introduce Linux and the services you already know on NetWare at your own pace and on your own terms.

Novell OES also lets you leverage your existing NetWare skills and expand the capabilities of your IT staff by attracting professionals with UNIX and Linux expertise.

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Reduce the Number of Supported Operating Systems

Many NetWare customers run a mix of platforms—including Microsoft Windows NT—in their environments. These customers are at a crossroads. As of 2005, Microsoft no longer offers non-security hot-fixes or technical support for Windows NT.

If your organization still uses Windows NT today, you're not alone. IDC estimates that there are still more than 2 million installed NT 4 servers. IDC also estimates that 17 percent of all Windows servers in use at the end of 2004 are still NT 4.

Moving to the newer Windows Server 2003 platform requires purchasing new hardware and new software licenses and making investments in expensive employee retraining. Gartner estimates that it costs an average of $279 per user to migrate from NT 4 to Windows 2000.

With Windows Vista on the horizon, cost-conscious IT executives must make a platform investment decision: commit to a long-term investment in Windows or benefit from the flexibility and cost savings of Linux and open source.

Novell OES offers an alternative by extending the benefits of Linux to meet your most pressing IT infrastructure and application needs.

Novell OES enables you to avoid Windows security problems.

And Novell OES is highly interoperable with Windows servers and clients, making it easy to migrate from Windows NT to Linux, without the disruptive rip-and-replace approach.

For example, Novell OES supports Windows clients using built-in protocols. It also integrates alongside existing Windows NT*/2000 Servers as well as Active Directory.

Plus, with Novell OES, you can lower your overall staffing costs by consolidating IT skills across other areas of your business where Linux is deployed.

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Novell OES works with your current Microsoft deployment. And when you are ready to migrate from Microsoft, it provides you with the tools and expertise you need to efficiently upgrade to an environment that offers more choice.

Novell OES Features

The following are some of the key features and components of Novell OES:

- Management Interfaces and Services
- Identity and Directory Services
- Infrastructure Services
- End User Services

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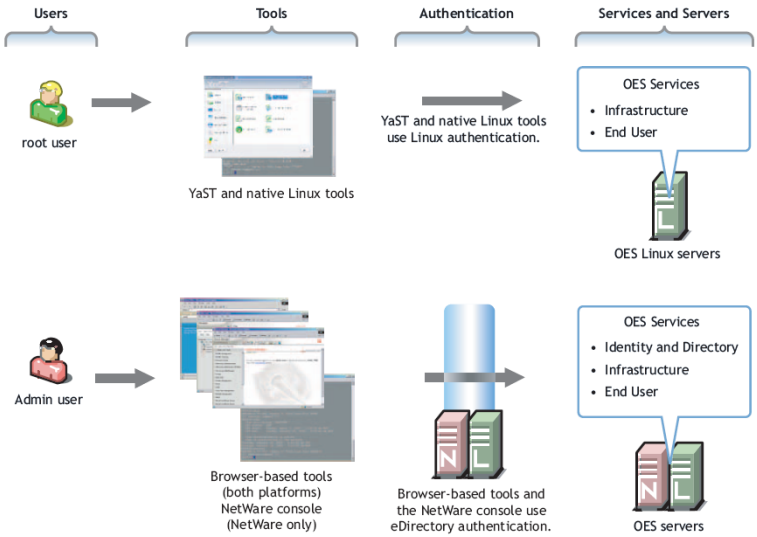
Management Interfaces and Services

As shown in the following, OES provides a rich set of service- and server-management tools, including browser- and server-based interfaces that help you implement and maintain your network:

Figure 1-3



Access to most of these management interfaces is controlled through eDirectory. However, a few interfaces, such as YaST on SLES 9 servers, require local authentication.

For a complete list of all OES utilities and tools, see “OES Utilities and Tools” on page 91 in the *Novell OES SP2 Planning and Implementation Guide* (implgde.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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Identity and Directory Services

Storing and managing network identities in directory services has become a fundamental expectation for networking.

Novell OES offers the most powerful and flexible identity management and directory services in the industry, including the following:

- eDirectory
- Identity Manager (Bundle Edition)

eDirectory

Novell eDirectory is a tree structure containing a list of objects (or identities) that represent network resources, such as

- Network users
- Servers
- Printers
- Applications

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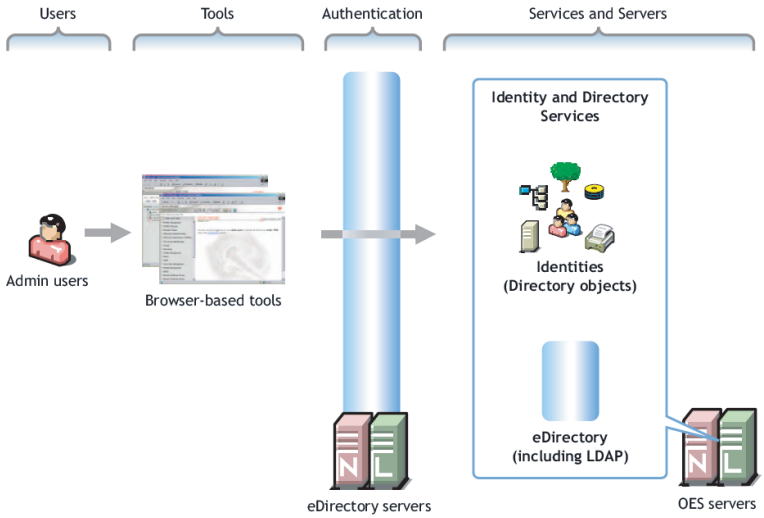
eDirectory is designed to provide easy, powerful, and flexible management of network resources (including eDirectory itself) in ways that no other directory service can match, as illustrated in the following:

Figure 1-4



Identity Manager (Bundle Edition)

OES includes Identity Manager Bundle Edition with the drivers required to let you synchronize identity information stored in Active Directory Domains, NT Domains, and eDirectory trees.

For more information, see “Using the Identity Manager Bundle Edition” on page 111 in the *Novell OES SP2 Planning and Implementation Guide* (implgde.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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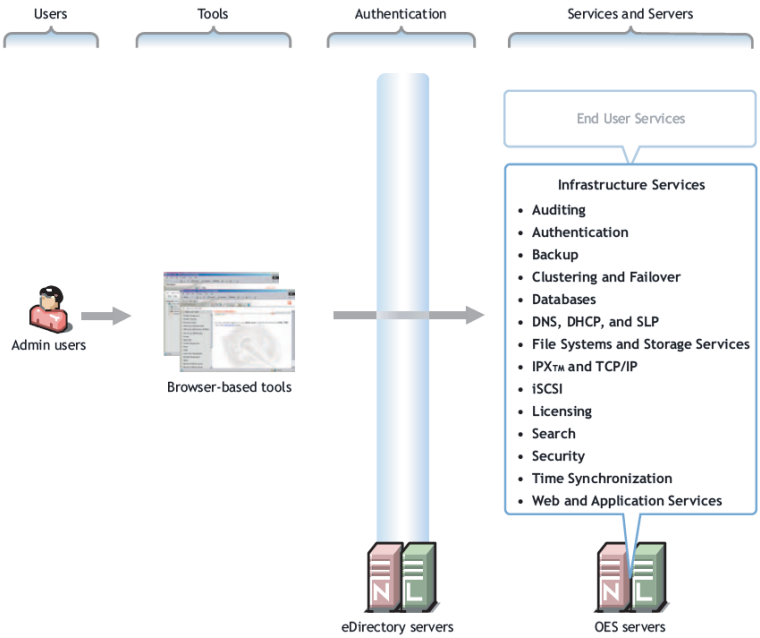
Infrastructure Services

OES network services require a number of underlying infrastructure services to support such things as

- Authentication of those seeking access to the network and its services
- Backup services to prevent data loss
- Network storage of end user files and other critical data
- Support for and management of all the required network protocols

The following illustrates that OES includes all the network infrastructure services that are required to meet these and other network services needs:

Figure 1-5



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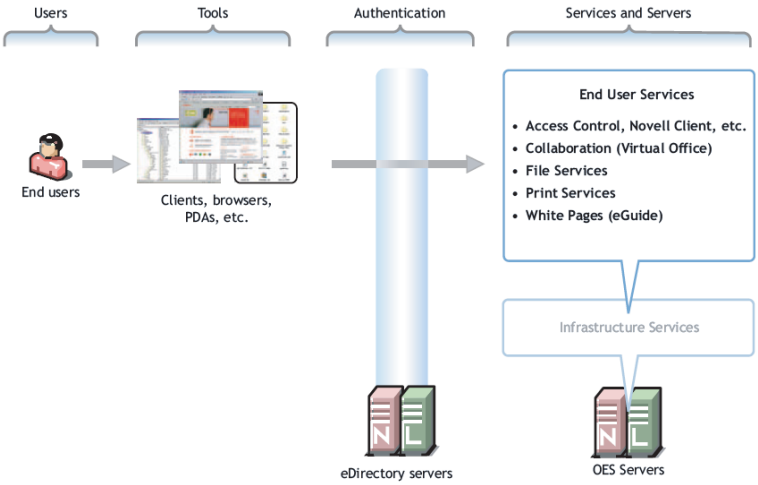
End User Services

Ultimately, networks exist to provide services to end users, and Novell is best known for the anywhere-accessible end user services it enables you to provide on your network.

The following illustrates the services that OES can provide to network users and the methods they can use to access those services:

Figure 1-6



These services (except for Virtual Office) are explained in greater detail later in this course.

For more information about Virtual Office, see the *Novell OES Virtual Office Configuration Guide* (virtualoffice.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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Objective 2 Decide Which OES Services to Install

As you plan which services to install on which OES platform, you probably have a number of questions.

The following helps answer your questions when deciding which OES services to install:

- What Services Are Included in OES?
- Which Services Do I Need?
- Which OES Platform Is Best for My Services?

What Services Are Included in OES?

The following summarizes the services and technology support available on each platform and the differences in the way these services are provided.

If you are interested in a service or technology not listed, or for documentation for listed services, see the *A–Z List* on the OES documentation web site at http://www.novell.com/documentation/oes.

Table 1-1

Service	OES Linux	OES NetWare
AFP (Apple File Protocol)	No	Yes - NFAP
Apache Web Server	Yes - Standard Linux	Yes - NetWare port of open source product
Archive and Version Services (Novell)	No	Yes
Backup (SMS)	Yes	Yes
Clustering	Yes	Yes
CIFS (Windows File Services)	Yes - Samba	Yes - NFAP

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(continued) **Table 1-1**

Service	OES Linux	OES NetWare
DFS (Novell Distributed File Services)	No	Yes
DHCP	Yes	Yes
DNS	Yes	Yes
eDirectory 8.7.3	Yes	Yes
eDirectory Certificate Server	Yes	Yes
eGuide (White Pages)	Yes	Yes
FTP Server	Yes	Yes
Health Monitoring Services	Yes	Yes
Identity Manager	Yes	Yes
iPrint	Yes	Yes
IPX™ (Internetwork Packet Exchange™) from Novell	No	Yes
iSCSI	Yes	Yes
LDAP Server for eDirectory	Yes	Yes
MySQL	Yes - Standard Linux	Yes - NetWare port of open source product
NCP™ Server	Yes	Yes
NetStorage	Yes	Yes
NFS	Yes - Native to Linux	Yes - NFAP
NICI (Novell International Cryptography Infrastructure)	Yes	Yes
NMAS™ (Novell Modular Authentication Services)	Yes	Yes

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(continued) **Table 1-1**

Service	OES Linux	OES NetWare
Novell Client™ for Windows and Linux support	Yes - through NCP Server for Linux or Novell Samba	Yes
Novell Cluster Services™	Yes	Yes
Novell iFolder® 2.*x*	Yes	Yes
Novell iFolder 3.*x*	Yes	No
Novell Licensing Services	No	Yes
NSS (Novell Storage Services™)	Yes	Yes
Nsure® Audit	Not included with OES. However, the Novell Audit 2.0 Starter pack is available for download at no cost at www.novell.com	Yes
NTPv3	Yes	Yes
OpenSSH	Yes - Standard Linux	Yes - NetWare port of open source product
PAM (Pluggable Authentication Modules)	Yes - eDirectory enabled	No - eDirectory authenticating is pervasive on NetWare
Pervasive.SQL	No (available at http://www.pervasive.com)	Yes
PKI (Public Key Infrastructure)	Yes - eDirectory	Yes - eDirectory
Printing	Yes - iPrint	Yes - iPrint
QuickFinder™	Yes	Yes

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(continued) **Table 1-1**

Service	OES Linux	OES NetWare
RADIUS	Yes - Novell RADIUS	Yes - Novell RADIUS
Samba	Yes - Novell Customized	No
Search (QuickFinder)	Yes	Yes
SLP	Yes - SLES 9	Yes - Novell
Software RAIDS (NSS volumes)	Yes (0 and 1)	Yes (0, 1, and 5)
Storage Management Services™ (SMS)	Yes	Yes
TCP/IP	Yes	Yes
Timesync NLM™	No	Yes
Tomcat	Yes - Standard Linux	Yes - NetWare port
NetWare Traditional File System	No	Yes
Virtual Office (Collaboration)	Yes	Yes
WAN Traffic Manager (for eDirectory)	No	Yes

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Which Services Do I Need?

OES probably includes services that you don't know about that could greatly enhance the business value of your network.

You are probably aware of some of the file and print services included in OES, but you might not know that

- OES includes a powerful search engine (QuickFinder) that can index local and Web content, providing you with a search application at no additional cost.
- Users running the Novell Client can map drives to locations on an OES Linux server running the NCP server for Linux.

Although this course focuses on helping you understand and evaluate OES print and file services, and some end user services such as iFolder, online resources for evaluating other services (such as QuickFinder) are also available at www.novell.com.

These resources include

- Novell Open Enterprise Server home page (http://www.novell.com/products/openenterpriseserver/)
- Novell Open Enterprise Server demo (http://www.novell.com/products/openenterpriseserver/ > **Demo**)
- Novell Open Enterprise Server features and benefits index page (http://www.novell.com/products/openenterpriseserver/features.html)
- Novell Open Enterprise Server evaluation download page (http://www.novell.com/products/openenterpriseserver/eval.html)
- Novell Open Enterprise Server porting and migration resources (http://developer.novell.com/wiki/index.php/Porting_and_Migration)
- Novell Open Enterprise Server deployment resources (http://www.novell.com/products/openenterpriseserver/deployment.html)

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Which OES Platform Is Best for My Services?

You have already seen that there are differences in the way OES provides services on SUSE Linux Enterprise Server (SLES) 9 and NetWare 6.5.

To help you better assess which OES platform can best meet your network service needs, you should consider the following:

- Platform Strengths
- Service Differences on the OES Platforms

Platform Strengths

Although both OES platforms provide a full set of network services, there are differences in the NetWare and Linux platforms:

Table 1-2

	OES NetWare	OES Linux
Brief description	Novell's network-optimized operating system	Novell's Linux operating system
Industry-recognized strengths	■ Reliability ■ Scalability ■ Security	■ Open application environment ■ Flexibility ■ Versatility

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(continued) **Table 1-2**

	OES NetWare	OES Linux
Business value propositions	NetWare excels in a highly distributed environment: ■ Increases network availability ■ Optimizes manageability ■ Enhances user productivity ■ Runs Apache, Tomcat, MySQL, and other open source applications	SLES 9 is well suited as an application server running Linux-based solutions: ■ Runs thousands of programs available from the open source community ■ Delivers OES file and print services ■ Hosts open source Web servers, proxy servers, and mail servers

Service Differences on the OES Platforms

In addition to considering platform strengths, you should understand the differences in the features available when services are running on Linux or NetWare.

The following examples illustrate this point:

- **DHS/DHCP.** NetWare DNS/DHCP services offer a broader spectrum of features than the basic DNS/DHCP functionality available in the standard Linux implementation.

  Many organizations find Linux DNS/DHCP services to be completely adequate.

  On the other hand, some organizations—especially those that currently leverage the advanced services available on NetWare—might be frustrated with the Linux implementation of DNS/DHCP and find it inadequate for their needs.

- **Novell Storage Services (NSS).** When deploying NSS, you might want support for Novell Distributed File Services (DFS) so you can move or split NSS volumes.

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This feature is currently available only on NSS running on NetWare.

You should fully investigate any service differences between platforms before you finalize your service/platform choices.

To help you, the following table indicates which services are the same, contains references to documentation that discuss service differences, and shows which services are unavailable on a given platform:

Table 1-3

Service	Explanations and References
Apache Web Server	See *Administration Instance vs. Public Instance on NetWare* at http://www.novell.com/documentation/oes/web_apache/data/ aipcu6x.html#aipcu6x. See *What's Different about Apache on NetWare* at http://www.novell.com/documentation/oes/web_apache/data/ail8hvj.html#ail8hvj.
Archive and Version Services	This Novell product is not supported on Linux.
Backup (SMS)	SBCON is not supported on Linux.
Clustering	See "Product Features" on page 9 in the *OES Novell Cluster Services 1.8.2 Administration Guide for NetWare* (cluster_admin.pdf). See "Product Features" on page 9 in the *OES Novell Cluster Services 1.8.2 Administration Guide for Linux* (cluster_admin_lx.pdf).
DFS (Distributed File Services)	Not supported in NSS for Linux.

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(continued) **Table 1-3**

Service	Explanations and References
DHCP	See “DHCP” on page 353 in the *SUSE LINUX Enterprise Server 9 Administration Guide* (sles_admin.pdf). See “Planning a DHCP Strategy” on page 57 in the *Novell OES DNS/DHCP Services Administration Guide* (dhcp_enu.pdf).
DNS	See “DNS - Domain Name System” on page 310 in the *SUSE LINUX Enterprise Server 9 Administration Guide* (sles_admin.pdf). See “Planning a DNS Strategy” on page 54 in the *Novell OES DNS/DHCP Services Administration Guide* (dhcp_enu.pdf).
eDirectory 8.7.3	No functional differences.
eDirectory Certificate Server	No functional differences.
eGuide (White Pages)	No functional differences.
FTP Server	See “Features of the NetWare FTP Server” on page 9 in the *NetWare FTP Server Administration Guide for OES* (ftp_enu.pdf).
Health Monitoring services	No functional differences. See the *Novell OES Health Monitoring Services Administration Guide* (server_health.pdf).
Identity Manager	No functional differences.
Novell iFolder 2.*x*	No functional differences.
Novell iFolder 3.*x*	For OES SP1 Linux and later; not for OES NetWare.

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(continued) **Table 1-3**

Service	Explanations and References
iPrint	See “Overview” on page 11 in the *Novell OES iPrint Administration Guide for Linux* (iprint_lx.pdf) See “Overview” on page 13 in the *Novell OES iPrint Administration Guide for NetWare* (iprint.pdf).
IPX (Internetwork Packet Exchange)	Novell doesn't provide this on Linux.
iSCSI	See “Linux-iSCSI Project” on the Web at http://linux-iscsi.sourceforge.net. See “Overview” on page 7 in the *Novell iSCSI for NetWare Administration Guide* (iscsi.pdf).
LDAP Server for eDirectory	No functional differences.
MySQL	See “MySQL” on the Web at http://www.mysql.com. See “Overview: MySQL” on page 9 in the *Novell OES MySQL for NetWare Administration Guide* (web_mysql.pdf).
NCP Server	See “Benefits of NCP Server” on page 9 in the *Novell OES NCP Server for Linux Administration Guide* (ncp_lx.pdf).
NetStorage	NetStorage on Linux offers connectivity to storage locations using the CIFS/SMB, NCP, and SSH protocols. NetWare uses only NCP.
NICI (Novell International Cryptography Infrastructure)	No functional differences.
NMAS (Novell Modular Authentication Services)	No functional differences.

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(continued) **Table 1-3**

Service	Explanations and References
Novell Client support (Linux and Windows)	No functional differences with NCP Server for Linux installed on OES Linux.
Novell Cluster Services	See “Product Features” on page 9 in the *OES Novell Cluster Services 1.8.2 Administration Guide for Linux* (cluster_admin_lx.pdf). See “Product Features” on page 9 in the *OES Novell Cluster Services 1.8.2 Administration Guide for NetWare* (cluster_admin.pdf).
Novell Licensing Services	Not available on Linux.
NSS (Novell Storage Services)	See “Coexistence and Migration Issues” on page 73 in the *OES Novell Storage Services File System Administration Guide* (nss_enu.pdf).
Nsure Audit	Not available on Linux.
NTPv3	See “Configure Time Synchronization on Novell OES” on page 5-4.
OpenSSH	See “Functions Unique to the NetWare Platform” on page 10 in the *Novell OES OpenSSH Administration Guide* (openssh.pdf).
PAM (Pluggable Authentication Modules)	Not available on NetWare. Authentication is fully integrated with eDirectory.
Pervasive.SQL	See the online documentation for Pervasive.SQL on the Web at http://www.pervasive.com/support/technical/online_manuals.asp.
PKI (Public Key Infrastructure)	No functional differences.
Printing	See **iPrint**.

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(continued) **Table 1-3**

Service	Explanations and References
RADIUS	No functional differences (NMAS).
QuickFinder	See **Search**.
Samba	Linux solution. NetWare has Native File Access Protocol Support.
Search (QuickFinder)	When indexing a file system, the QuickFinder engine indexes only what it has rights to see. On NetWare, it has full access to all mounted volumes. On Linux, it has rights to only the files that the novlwww user in the www group has rights to see. For more information, see “Security Characteristics” on page 156 and “Generating an Index for a Linux-Mounted NSS Volume” on page 81 in the *Novell QuickFinder Server 4.2 Administration Guide* (qfserver.pdf).
Server resource management (eDirectory)	eDirectory on NetWare manages server resources. For example, you can view and modify file system information, manage files and folders on NetWare volumes, salvage and purge deleted files, allocate volume space, and create objects to facilitate file management. For additional information, see “Managing Objects” on page 87 in the *Novell eDirectory 8.7.3 Administration Guide* (edir873.pdf). The current version of eDirectory for Linux does not support management of server resources.

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(continued) **Table 1-3**

Service	Explanations and References
SLP (Novell SLP) (OpenSLP)	See “SLP Support in SUSE LINUX” on page 308 in the *Novell SUSE LINUX Enterprise Server Administration Guide* (sles_admin.pdf). See “Implementing the Service Location Protocol” on the Web at http://www.novell.com/documentation/edir87/edir87/data/a2iiimc.html. Also see the home page of the OpenSLP project on the Web at http://www.openslp.com. By default, NetWare uses Novell SLP, which provides synchronization between Directory Agents (DAs) that are in the same eDirectory context. This provides service information beyond the local network. Alternatively, you can implement OpenSLP for eDirectory. Be aware, however, that DA synchronization is not supported in OpenSLP. OpenSLP on Linux is not customized to provide DA synchronization.
Software RAIDS	See “Understanding Software RAID Devices” on page 117 in the *OES Novell Storage Services File System Administration Guide* (nss_enu.pdf).
Storage Management Services (SMS)	No functional differences.
TCP/IP	No functional differences.
Timesync	Not available on Linux, but NTPv3 is supported on both OES platforms.

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(continued) **Table 1-3**

Service	Explanations and References
Tomcat	See “Administration Instance vs. Public Instance of Tomcat on NetWare” on the Web at http://www.novell.com/documentation/oes/web_tomcat/data/ahdyran.html#ahdyran.
NetWare Traditional File System	Not available on Linux.
Virtual Office (Collaboration)	No functional differences.
WAN Traffic Manager	Not supported on Linux. See “WAN Traffic Manager” on page 229 in the *Novell eDirectory 8.7.3 Administration Guide* (edir873.pdf).

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Objective 3 Plan Your OES Implementation

Once you understand the components available in Novell OES and have decided which services to install, you are ready to begin planning your OES implementation.

The following are key planning steps you should follow to successfully implement Novell OES:

- Plan for eDirectory
- Prepare Your Existing eDirectory Tree for OES
- Identify a Purpose for Each Server
- Evaluate Server Requirements
- Evaluate User Restrictions and Linux User Management
- Consider Coexistence and Migration Issues
- Review Your Installation Options Before You Start
- How to Get OES Through Upgrade Protection

For details on installing and upgrading to Novell OES, see “Installing OES” on page 55 and “Upgrading to OES” on page 61 in the *Novell OES SP2 Planning and Implementation Guide* (implgde.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

Plan for eDirectory

Novell eDirectory is the heart of OES network services and security. When planning for eDirectory, you need to consider the following guidelines:

- Installing Into an Existing Tree
- Creating a New eDirectory Tree

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Installing Into an Existing Tree

If you are installing into an existing tree, be sure you understand the following:

- Coexistence Issues
- Migration Issues

Coexistence Issues

The following table lists the operating systems and eDirectory versions that OES NetWare and OES Linux have been tested with (and found to be compatible with):

Table 1-4

Platform	eDirectory Version
NetWare 6.5 SP2	eDirectory 8.7.3 IR2 (eDirectory 8.7.3.2)
NetWare 6.0 SP5	eDirectory 8.6.2
NetWare 5.1 SP8	eDirectory 8.7.3
NetWare 5.1 SP7	eDirectory 8.7.3
NetWare 5.1	NDS® 8 (must have latest NDS 8 and eDirectory 8.7 schema extensions)
NetWare 4.2	NDS 6 (6.21 or later)
SLES 9	eDirectory 8.7.3
SUSE LINUX Professional 9.1	eDirectory 8.7.3
Red Hat AS 3.0	eDirectory 8.7.3 IR 3 (eDirectory 8.7.3.3)
Windows 2003 Server	eDirectory 8.7.3 IR 3 (eDirectory 8.7.3.3) or later
Windows 2003 Server	Active Directory (synchronized users via Identity Manager)
Windows 2000 Advanced Server	eDirectory 8.7.3 IR 3 (eDirectory 8.7.3.3) or later

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(continued) **Table 1-4**

Platform	eDirectory Version
Windows NT	NT Domain (synchronized users via Identity Manager)

There are no known eDirectory coexistence issues for Linux. However, the following are NetWare coexistence issues:

- On NetWare, use Deployment Manager to check the tree for the correct versions of NDS/eDirectory and to determine if the needed schema extensions are present.
- There are several issues with NetWare 5.1 SP7 and NDS 8 regarding SLP and LDAP authentication.

  If you cannot upgrade to NetWare 5.1 SP8, apply the sas.nlm and SLP modules from NetWare 5.1 SP8 for LDAP and SLP compatibility.

  If the sas.nlm module is not applied, an OES Linux server installed into a NetWare 5.1 SP7 tree hangs during installation during LDAP authentication.

  If the SLP modules are not applied, the NetWare 5.1 SP7 server might not be able to work correctly with the Linux version of OpenSLP.

Migration Issues

The following provides information on migrating a previous installation of eDirectory to the OES version (eDirectory 8.7.3 IR5):

- **NetWare caveats.** For NetWare, a migration is the same as an upgrade.

  For details, see “Upgrading to OES NetWare” on page 69 in the *OES NetWare Installation Guide* (install-nw.pdf).
- **Linux caveats.** The following are some issues you need to consider when migrating to Linux:
  - Upgrades from Novell Nterprise Linux Services (NNLS) are not supported, but upgrades from SLES 9 with eDirectory 8.7.3 to OES Linux are supported.

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- If you attempt to install OES Linux on a server that already has eDirectory 8.7.3 installed, the eDirectory included with OES (eDirectory 8.7.3 IR 5) overwrites the previous eDirectory installation.

  You should install OES on a clean computer. Do not try to upgrade eDirectory.

- Installing OES Linux into a NetWare 6.5 SP2 tree causes the NetWare server to abend due to an issue in NetWare 6.5 SP2 that is fixed in NetWare 6.5 SP3.

  Before installing an OES Linux server into a NetWare 6.5 SP2 tree, upgrade any NetWare 6.5, NetWare 6.5 SP1, and NetWare 6.5 SP2 LDAP servers that will be pointed to by the OES installation to NetWare 6.5 SP3.

Creating a New eDirectory Tree

If you are creating a new eDirectory tree on your network, you must do some additional planning before you install the first server into the tree.

The first server is important for two reasons:

- You create the basic eDirectory tree structure during the first installation
- The first server permanently hosts the Certificate Authority for your organization

To ensure that your eDirectory tree meets your needs, take time to plan the following:

- **Structure of the eDirectory tree.** A well-designed tree provides containers for servers, users, printers, etc. It is also optimized for efficient data transfer between geographically dispersed locations.

  For more information, see “Designing Your Novell eDirectory Network” on page 67 in the *Novell eDirectory 8.7.3 Administration Guide* (edir873.pdf).

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- **Time synchronization.** eDirectory requires that all OES servers, both NetWare and Linux, be time synchronized.

  For more information, see "Configure Time Synchronization on Novell OES" on page 5-4.

- **Partitions and replicas.** eDirectory allows the tree to be partitioned for scalability. Replicas (copies) of the partitions provide fault tolerance within the tree.

  The first 3 servers installed into an eDirectory tree automatically receive replicas of the tree's root partition. You might want to create additional partitions and replicas.

  For more information, see "Managing Partitions and Replicas" on page 113 in the *Novell eDirectory 8.7.3 Administration Guide* (edir873.pdf).

Prepare Your Existing eDirectory Tree for OES

If you are installing OES into an existing tree, you must use Deployment Manager (located on the *OES NetWare 6.5 SP5 CD 1*) to see whether your tree requires any updates.

Identify a Purpose for Each Server

Large networks usually have one or more servers dedicated to providing a single network service.

For example, one or more servers might be designated to provide Novell iFolder file services to network users while other servers provide iPrint printing services for the same users.

For smaller organizations, it is often not practical or cost effective to dedicate servers to providing a single service. For example, the same server might provide both file and print services to network users.

Prior to installing a new server on your network, you should identify the service or services that it will provide.

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Evaluate Server Requirements

OES Linux and OES NetWare both have specific hardware and software requirements.

Prior to installing OES, you need to make sure your server machine and network environment meet the following requirements:

- OES Linux Server
- OES NetWare Server

OES Linux Server

Before starting a Novell OES for Linux installation, you need to understand the following:

- Software Requirements
- Hardware Requirements

Software Requirements

As part of the OES Linux installation, you install SUSE Linux Enterprise Server 9 SP3.

Hardware Requirements

Before installing OES Linux, make sure your system meets at least the following minimum hardware requirements:

Table 1-5

Component	Minimum Requirements
Computer	Server-class computer with Pentium* II or AMD* K7 450 MHz processor
Memory	512 MB
Free Disk Space	6 GB available unpartitioned disk space

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(continued) **Table 1-5**

Component	Minimum Requirements
CD-ROM	4x CD-ROM drive
Hard Drive	20 GB
Network Board	Ethernet 100 Mbps
IP Address	■ One IP address on a subnet If installing Novell iFolder, you need an additional IP address. iFolder requires a separate IP address on Linux. ■ Subnet mask ■ Default gateway
Mouse	N/A
Server computer BIOS	If doing a CD-ROM installation, prepare the BIOS on your server computer so that it boots from the CD-ROM drive first.

While the minimum requirements let you install OES Linux, they can limit the Novell services you can expect to run, not to mention the performance and reliability of the system.

If you plan to put your system into production and keep your users happy, you should use hardware that meets or exceeds the following recommended requirements:

Table 1-6

Component	Recommended Requirements
Computer	Server-class computer with Pentium III, Pentium III Xeon*, Pentium 4, Intel* Xeon 700 MHz, AMD K8 CPUs (Athlon64 and Opteron), Intel EM64T, or higher processor. Note that OES runs in 32-bit mode only.
Memory	1 GB of RAM
Free Disk Space	10 GB available, unpartitioned disk space. Additional disk space might be required depending on which OES components you select and how you plan to use them.

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(continued) **Table 1-6**

Component	Recommended Requirements
CD-ROM	48x CD-ROM drive
Hard Drive	20 GB
Network Board	Ethernet 100 Mbps
IP Address	■ One IP Address on a subnet If installing Novell iFolder, you need an additional IP address. iFolder requires a separate IP address on Linux. ■ Subnet mask ■ Default gateway
Mouse	USB or PS/2
Server computer BIOS	If doing a CD-ROM installation, prepare the BIOS on your server computer so that it boots from the CD-ROM drive first.

Depending on the Novell service you plan to implement, you might need additional hardware beyond the recommended requirements.

For example, if you plan to deploy iFolder, you will probably need much more disk space.

OES NetWare Server

OES NetWare runs on the following minimum system requirements:

- A server-class PC with a Pentium II or AMD K7 processor
- 512 MB of RAM
- A Super VGA display adapter
- A DOS partition of at least 200 MB and 200 MB available space
- 1 GB of available, unpartitioned disk space outside the DOS partition for volume SYS
- One network board

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- A bootable CD drive that supports the El Torito specification

For optimal performance, OES NetWare has the following recommended system requirements:

- A server-class PC with two-way Pentium III, Pentium III Xeon, Pentium 4, or Intel Xeon 700 MHz or higher processors
- 1 GB of RAM

  Some OES NetWare installation options (patterned deployments) have specific processor and RAM requirements.
- A VESA 1.2-compliant, high-resolution display adapter
- A boot partition with 1 GB of available space

  To determine the optimal size of a boot partition, add the amount of server memory to the minimum amount of the available disk space.

  The minimum amount of available space is 200 MB, so a server with 1024 MB RAM has an optimal boot partition of 1224 MB (1024 MB + 200 MB = 1224 MB).

  This size allows you to do a core dump to the disk drive if required.
- 4 GB of available, unpartitioned disk space outside the boot partition for volume SYS
- One or more network boards
- A bootable CD drive that supports the El Torito specification
- A USB or PS/2 mouse

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Evaluate User Restrictions and Linux User Management

If you plan to use Linux User Management, you need to understand the security implications before you accept the default PAM-enabled service settings.

Seasoned NetWare administrators are accustomed to being able to set various user access restrictions, including the following:

- Account balance restrictions
- Address restrictions
- Intruder lockout
- Login restrictions
- Password restrictions
- Time restrictions

Many of the management interfaces that set these restrictions (iManager, for example), might seem to imply that these restrictions apply to users who are accessing an OES server using any protocol.

This is generally true, with two important exceptions:

- Maximum number of concurrent connections in login restrictions
- Address restrictions

These two specific restrictions are enforced only for users that are accessing the server using NCP.

Connections through other access protocols (for example, HTTP or CIFS) have no concurrent connection or address restrictions imposed.

For this reason, you will probably want to consider not enabling services such as ssh and ftp for PAM access when setting up Linux User Management.

For more information on Linux User Management, see “Configure eDirectory Users to Access an OES Linux Server” on page 5-20.

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Consider Coexistence and Migration Issues

You probably already have a network that is providing services to network users.

In many cases, the services you are currently running will influence your approach to implementing OES. In some cases, there are specific paths to follow so that the OES integration process is as smooth as possible.

Novell has invested considerable effort in identifying service coexistence and migration issues you might face. We understand, however, that we can't anticipate every combination of services that you might have.

Therefore, we intend to continue developing coexistence and migration information after each OES product release, and we plan to update the Web-based documentation regularly with the newly developed information.

Some of the most common issues are outlined in "Installation/Upgrade/Migration Caveats" on page 55 of the *Novell OES SP2 Implementation and Planning Guide* (implgde.pdf).

For detailed information about coexistence of OES servers with existing NetWare and Linux networks, and for migration instructions, see the *Novell OES Coexistence and Migration Guide* (coexist-mig).

Review Your Installation Options Before You Start

Before installing OES, you should be aware of the following information:

- OES Linux Installation Overview
- OES NetWare Installation Overview
- Use Predefined Server Types (Patterns) When Possible
- If You Want to Install NSS on a Single-Drive Linux Server

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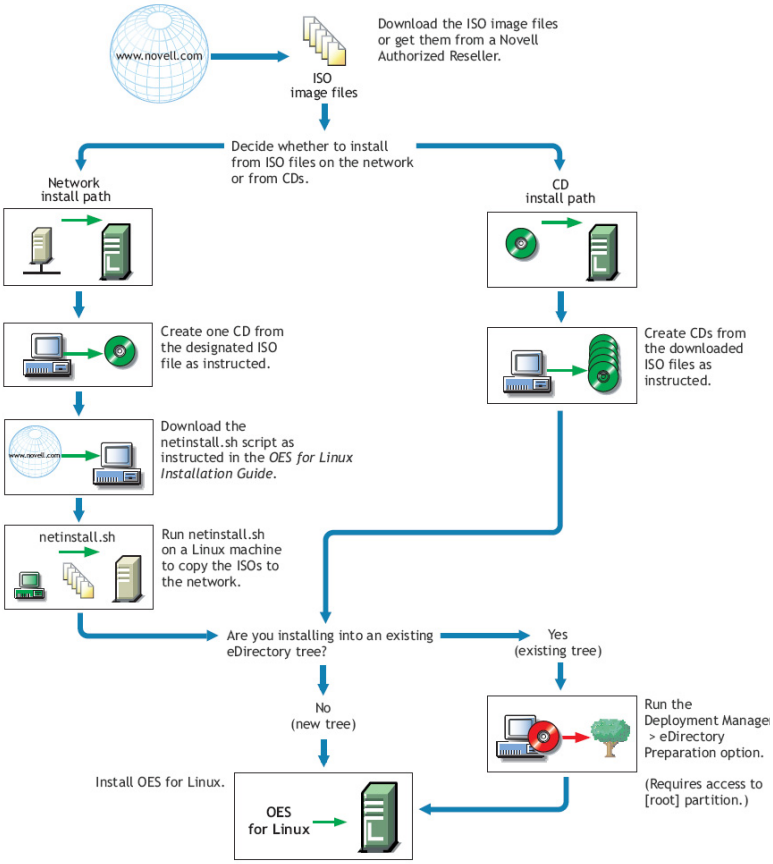
OES Linux Installation Overview

The software and network preparation processes required to install OES Linux are outlined in the following:

Figure 1-7



OES Linux includes two installation options, both of which are documented in the *OES for Linux Installation Guide*:

- **CD install.** You can install using CDs obtained from a Novell Authorized Reseller, or you can create CDs from downloaded ISO image files.

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- **Network install.** You can install using only the first CD if the remaining ISO files are available on the network.

  This option can save you from swapping CDs on the server during the installation.

For detailed instructions, see “Installing Open Enterprise Server (OES) Linux” on page 23 in the *OES Linux Installation Guide* (install_linux.pdf).

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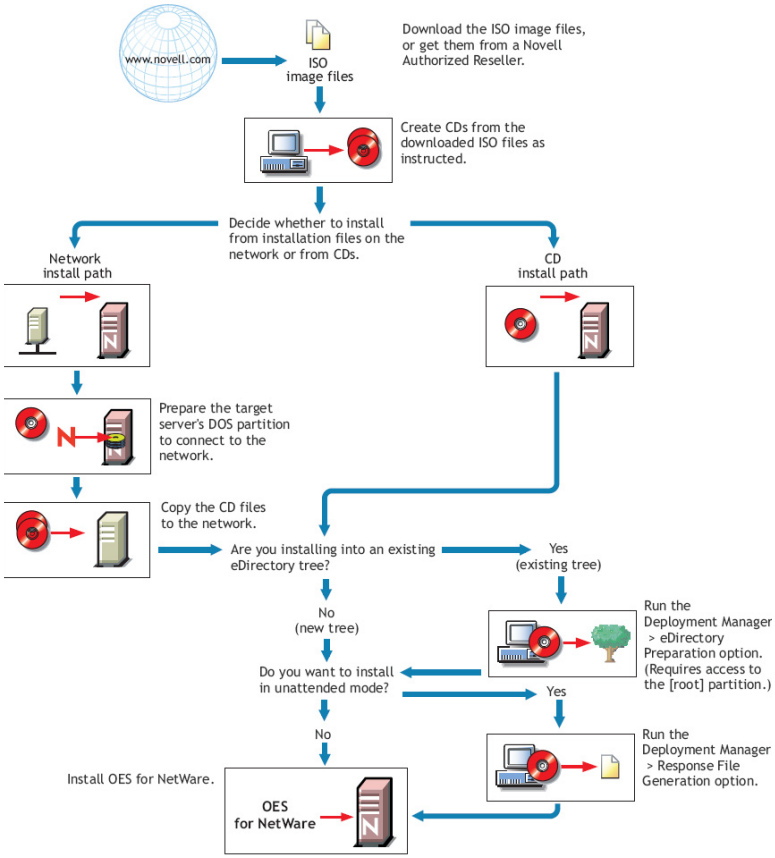
OES NetWare Installation Overview

The software and network preparation processes required to install OES NetWare are outlined in the following:

Figure 1-8



OES NetWare includes two installation options, both of which are documented in the *OES for NetWare Installation Guide*:

- **CD install.** You can install using CDs obtained from a Novell Authorized Reseller, or you can create CDs from downloaded ISO image files.

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- **Network install.** You can install from the network if you have prepared the DOS partition with Novell Client software and copied the CD files to the network.

  This option can save you from swapping CDs on the server during the installation.

For detailed installation instructions, see “Installing OES NetWare” on page 27 in the *OES NetWare Installation Guide* (install_nw.pdf).

Use Predefined Server Types (Patterns) When Possible

Both OES platforms include predefined server installation options that install only the components required to provide a specific set of network services.

In the OES Linux install, these installation options are called *server types*; in the OES NetWare install, these installation options are called *patterns*.

For example, if you want to install an OES server that supports a Web-based, user-configurable collaboration environment, you should select the Virtual Office Server server type during the OES installation.

You should always choose a predefined server type if one fits the intended purpose of your server. If not, you can choose to install a customized OES server with the service components you need.

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The following server types are available in an OES Linux installation:

Table 1-7

Predefined Server Type	Description and Packages Installed
Novell QuickFinder Server	Installs a search server that lets users find the information they're looking for on Web sites and attached file systems. KDE is not installed.
Novell iFolder2 Server	Installs a server that lets mobile users access their local files from anywhere—online, offline, all the time. KDE is not installed.
Novell Virtual Office Server	Installs a collaboration solution that lets users be self-sufficient with their IT needs. KDE is not installed.
Novell Management Server	Installs iManager, YaST (text-based), and the basic runtime system. KDE and graphical base system are not installed.
Novell Print Server	Installs a printing system that installs workstation print drivers and gives access to local printers and remote printers with Internet connections. KDE is not installed.
Novell Open Enterprise Server	The default server pattern installs the SLES 9 Default installation and most OES services. KDE is installed.

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The following patterns are available in an OES NetWare installation:

Table 1-8

Server Pattern	Description
Customized NetWare Server	Lets you select the optional products you want on the server.
Basic NetWare File Server	Installs only basic NetWare with no additional products.
Pre-Migration Server	Creates a server that data will be migrated to at a later time using the NetWare Migration Wizard.
DNS/DHCP Server	Sets up the Novell eDirectory tree for directory-enabled DNS/DHCP services.
exteNd J2EE Web Application Server	Installs an optimized configuration of the Novell exteNd Application Server.
LDAP Server	Installs Lightweight Directory Access Protocol (LDAP) Services for Novell eDirectory.
NetWare AMP (Apache, MySQL, PHP, and Perl) Server	Lets you host open source Web database applications on a NetWare 6.5 server.
NetWare Backup Server	Installs the infrastructure for backup and restore services on the NetWare platform.
QuickFinder Server	Installs a search server that lets users find the information they're looking for on Web sites and attached file systems.
Network Attached Storage (NAS) Server	Installs multiple-file protocol storage for your network.
Novell iPrint Server	Installs a printing system that installs workstation print drivers and gives access to local printers and remote printers with Internet connections.

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(continued) **Table 1-8**

Server Pattern	Description
Apache/Tomcat Server	Installs Apache Web Server and the Jakarta-Tomcat Servlet Container for use in hosting dynamic, application-driven Web sites.
Novell Nsure Audit Starter Pack Server	Installs the centralized auditing service that is built into OES NetWare.
iSCSI SAN Storage Server	Turns your OES NetWare server into an iSCSI Storage Server (also known as an iSCSI Target).
Novell iFolder Storage Services	Installs a server that lets mobile users access their local files from anywhere—online, offline, all the time.
Management Server	Installs Novell iManager 2.5 and Novell ConsoleOne 1.3.6 network administration software to provide a complete management solution for your server environment.
Virtual Office Server	Installs a collaboration solution that lets users be self-sufficient with their IT needs.

If You Want to Install NSS on a Single-Drive Linux Server

Many network administrators are interested in Novell Storage Services (NSS) running on Linux.

If you plan to experiment with NSS on a single-drive server, be sure to follow the instructions in “Installing Linux with EVMS as the Volume Manager of the System Device” on page 117 in the *OES Linux Installation Guide* (install_linux.pdf).

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Objective 4 Purchase and License Novell OES

As part of your plan to implement Novell OES, you need to understand the following about purchasing and licensing Novell OES:

- How to Get OES Through Upgrade Protection
- How to Purchase OES
- Novell OES Licensing

How to Get OES Through Upgrade Protection

If you have Novell Upgrade Protection, you can upgrade to OES and the latest support pack free of charge.

For more information and to start the upgrade process, do the following:

1. Using your Novell account information, log in to the Novell Web Site (http://www.novell.com/nps).
2. Access the Customer Care page by selecting the **Customer Care** icon.
3. Follow the instructions on the Customer Care page to obtain the upgrade to Open Enterprise Server and the latest support pack.

How to Purchase OES

If you have decided to purchase OES, visit the Novell How to Buy OES Web page at http://www.novell.com/products/openenterpriseserver/howtobuy.html.

With your OES purchase, you receive

- An activation code for enabling your OES Linux servers to receive online updates, including the latest support pack.
- A pair of license files for installing OES NetWare servers.

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After you purchase OES, OES NetWare support packs are available at no charge on the Novell Support Web site at http://support.novell.com/filefinder/.

As part of the purchase process, it is important that you understand the OES licensing model under “Novell OES Licensing” on 1-48.

Novell OES Licensing

To understand OES licensing, you need to know the following:

- OES Licensing Model
- Licensing on OES NetWare
- Licensing on OES Linux

Contact your Novell account executive or partner, or visit www.novell.com/oes for detailed pricing information. Some restrictions and terms may apply.

OES Licensing Model

All OES licenses are purchased on a user-connection basis. The number of servers you are authorized to install is different for each platform, as follows:

- **OES NetWare Servers.** The only licensing restriction that applies is the number of user connections allowed on your network.

  You are authorized to install as many OES NetWare servers as you need to provide services to those users.

  For example, if your OES license is for 100 user connections, you can install as many OES NetWare servers as desired. Up to 100 users can then connect to and use the services provided by the OES NetWare servers.

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- **OES Linux Servers.** The same restriction applies to the number of user connections allowed on your network.

  However, in contrast to OES NetWare, the number of OES Linux servers you are authorized to install is also restricted, as follows:

  - For the first 50 licensed user connections, you are authorized to install one OES Linux server for every 10 connections.
  - After the first 50 user connections, you are authorized to install one OES Linux server for every 50 connections.

  For example, if your OES license is for 100 user connections, you are authorized to install up to six OES Linux servers (five for the first 50 connections and one for the remaining 50 connections).

For more information on OES licensing, see the OES Licensing page on the Novell Web site at http://www.novell.com/licensing/oes_licensing.html.

Licensing on OES NetWare

When you install or upgrade NetWare, the server installation software automatically installs the Novell Licensing Services (NLS) software.

During the installation of the first NetWare server in a tree, you are prompted for a license/key file pair (*.nlf and *.nfk).

After installing OES, you can use Novell iManager to install and manage license certificates in your eDirectory tree and monitor NetWare usage. You can also monitor usage of Novell Licensing Services-enabled products.

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For additional information, see “How Novell Licensing Services Works” on page 13 in the *OES Licensing Services Administration Guide for NetWare* (nlsadmin.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

Licensing on OES Linux

In contrast with installing OES on the NetWare platform, installing OES on the Linux platform doesn’t require a license/key file pair (*.nlf and *.nfk).

However, you are required to accept an end user license agreement (EULA) to install OES on either platform. Your rights to use the OES product are limited to the rights set forth in the EULA.

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Objective 5 Upgrade to Novell OES NetWare

With the introduction of Novell Open Enterprise Server (OES), you can now take advantage of running Novell services and management tools on SUSE LINUX Enterprise Server.

However, many Novell customers continue to use NetWare as their preferred choice for file, print, and networking services until they are prepared to move to a Linux platform.

For those who plan to continue using NetWare, upgrading to OES NetWare is an important step in migrating to Novell Open Enterprise Server.

If your migration plans include an upgrade to OES NetWare, you need to do the following:

- Review Upgrade Guidelines Options for OES NetWare
- Check System Requirements
- Determine the Services to Install
- Verify Rights for Upgrading to OES NetWare
- Prepare the Network with Deployment Manager
- Prepare the Computer
- Start an In-Place Server Upgrade
- Complete the OES NetWare Server Upgrade
- Complete Post-Installation Tasks

For additional details on installing or upgrading to OES NetWare, see the *Novell Open Enterprise Server Installation Guide for NetWare* (install-nw.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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Review Upgrade Guidelines Options for OES NetWare

The NetWare server platform for OES Support Pack 2 is NetWare 6.5 with Support Pack 5.

Novell no longer distinguishes between a NetWare 6.5 Support Pack installation and the OES NetWare installation. NetWare 6.5 SP5 and OES SP2 on NetWare are the same product and use the same installation program and CD set.

Installing OES SP2 on NetWare is the same as installing NetWare 6.5 with Support Pack 5. Applying the NetWare 6.5 SP5 update is the same as upgrading to OES SP2 for NetWare.

When you install or upgrade to OES SP2 for NetWare, the following updated products are available for you to install:

- **Novell iManager 2.5.** This cross-platform version of iManager lets you manage both OES NetWare and OES Linux servers.

  Version 2.5 also includes enhanced performance and a new administration interface that does not manage Virtual Office 1.0.

Remember that iManager is dependent on the Apache2 Web Server and Tomcat 4 Servlet Container being installed or upgraded.

For details about other changes from version 2.0.2, see “What's New in Version 2.5” on page 7 of the *Novell iManager 2.5 Administration Guide* (imanager_admin_25.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

- **Novell QuickFinder™ Server 4.2** (replaces NetWare Web Search Server). QuickFinder Server is a Web and file system search engine that includes several new and enhanced features.

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If you install QuickFinder Server on an existing NetWare server with Web Search Server installed, the QuickFinder install recognizes the older installation, and migrates the configuration settings and indexes that QuickFinder uses.

However, you must regenerate the old indexes before they can be searched.

For additional details, see the *Novell QuickFinder Server 4.2 Administration Guide* (qfserver.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

- **Virtual Office.** Virtual Office is not included in OES SP2. Existing Virtual Office installations will continue to run on servers updated to OES SP2.

  If you are creating a new server and want to install Virtual Office, install it using the OES SP1 CDs; then update or patch the server to OES SP2.

  The OES SP1 CD images are available on the Novell Support Web site at http://support.novell.com/tools/csp/csp_oes.html.

  In OES SP1, the administration interface for Virtual Office was removed from iManager and incorporated into Virtual Office 1.5.

- **iManager 2.5.** If you want to upgrade from iManager 2.0.2 to iManager 2.5, do a product install of iManager 2.5 using the NetWare 6.5 SP5 overlay CDs *after* you have applied the SP5 updates in NWCONFIG.

Before upgrading from NetWare 5.1 or NetWare 6.0 using the overlay CDs, you should back up any server configuration files that you have customized. After the upgrade, you can restore the customized files if necessary.

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You should also be aware that in OES NetWare, the following components have been removed and can no longer be selected for installation:

- **Novell Nterprise™ Branch Office™ Rsync Server.** The pattern install for the Nterprise Branch Office - Central Office Server has been removed.

  You can upgrade an existing NBO Central Office Server, but you cannot install a new one.

- **Novell Nsure® UDDI Server.** In previous versions of NetWare 6.5, this component was installed with the exteNd™ J2EE Web Application Server, Apache/Tomcat Server, and Novell Nsure Audit Starter Pack Server patterns.

  Only the UDDI Server component has been removed; the three server patterns remain available.

Unless otherwise noted in the documentation, all other previously available products and functionality of NetWare 6.5 continue to be available in OES NetWare.

The following are server deployment options for OES NetWare:

Table 1-9

Installation/Upgrade Option	When to use
New installation of OES NetWare on standard hardware	You have new server-class PC hardware and you want to install OES NetWare on it for the first time.
Unattended installation of OES NetWare	You want to run an unattended or “silent” installation of OES NetWare using a response file.
In-place upgrade of existing NetWare server to OES NetWare	You have an existing NetWare 5 or later server and you want to upgrade it to OES NetWare locally, from the server itself.

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(continued) **Table 1-9**

Installation/Upgrade Option	When to use
Remote upgrade of existing NetWare server to OES NetWare	You have an existing NetWare 5 or later server and you want to upgrade it to OES NetWare remotely, through Novell Deployment Manager or iManager.
Unattended upgrade of existing NetWare server to OES NetWare	You have an existing NetWare 5 or later server and you want to run an unattended or “silent” upgrade to OES NetWare using a response file.
New installation of OES NetWare on a VMware Virtual Machine	You have a VMware server and you want to install OES NetWare on it as a guest operating system.

Check System Requirements

The following are system requirements for upgrading to OES NetWare:

- Software Requirements
- Hardware Requirements

Software Requirements

The server you want to upgrade must be running one of the following:

- NetWare 5.1 server with Support Pack 6 or later

  The minimum eDirectory level required to upgrade to OES NetWare is eDirectory version 8.6 or later.

  Upgrading to OES NetWare from NetWare 5.1 Support Pack 6 and eDirectory version 8.5 is not supported.

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Upgrading to OES NetWare from NetWare 5.1 running NDS® version 7 or later *is* supported, providing that Deployment Manager is first run to prepare the network for the new OES NetWare server.

- NetWare 6.0 server with Support Pack 5 or later
- NetWare 6.5 (FCS, Support Pack 1.1, Support Pack 2, Support Pack 3, or Support Pack 4)

The server to be upgraded cannot be in a tree that contains NetWare 4.10 servers. All servers in the tree must be NetWare 4.11 or later.

In addition, note the following:

- If you plan to run the upgrade from CDs, you need the drivers required to access the CDs.
- If you plan to upgrade using the NetWare installation files copied to another NetWare server running IP, you need the IP Server Connection utility.

Hardware Requirements

While OES NetWare can run on a minimal set of hardware system requirements (see the *OES NetWare Installation Guide*), for optimal performance, Novell recommends the following:

- A server-class PC with two-way Pentium III, Pentium III Xeon, Pentium 4, or Intel Xeon 700 MHz or higher processors
- 1 GB of RAM

  Some OES NetWare installation options (patterned deployments) have specific processor and RAM requirements.
- A VESA 1.2-compliant, high-resolution display adapter
- A boot partition with 1 GB of available space

  To determine the optimal size of a boot partition, add the amount of server memory to the minimum amount of the available disk space.

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The minimum amount of available space is 200 MB, so a server with 1024 MB RAM has an optimal boot partition of 1224 MB (1024 MB + 200 MB = 1224 MB).

This size lets you do a core dump to the disk drive if required.

One way to determine how much free space is available on the server's boot (DOS) partition is to mount the partition as an NSS volume. You can do this by loading the **dosfat.nss** module.

After you load the dosfat.nss module, any DOS FAT partitions on the server's hard drive are dynamically made available as NSS volumes. You can then use the **nss space** command to view how much space is used and available.

The volume name displayed by the **nss space** or **volumes** command is dosfat_*x*, where *x* is the drive letter, for example dosfat_c.

- 4 GB of available, unpartitioned disk space outside the boot partition for volume SYS
- One or more network boards
- A bootable CD drive that supports the El Torito specification
- A USB or PS/2 mouse

Determine the Services to Install

Novell networking services delivered as part of OES include the following:

- Directory services and identity management including Novell eDirectory and Identity Manager
- File services including Novell Storage Services (NSS) and Novell iFolder
- Print services including Novell iPrint
- Collaboration services including Virtual Office (not available in OES SP2)

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- Open source services including Apache, Tomcat, MySQL, and PHP/Perl
- Software distribution and patch management services including RPM Package Manager (RPM) and Red Carpet Daemon (RCD)
- Management consoles and interfaces common to all services through Novell iManager

The services you choose to install will depend largely on the intended purpose of your OES server. To simplify the process of installing special-purpose servers, Novell provides a patterned deployment feature.

For example, if you want to install an OES server with all of the components necessary to host open-source Web-based applications, you simply select the NetWare AMP (Apache, MySQL, PHP, and Perl) Server pattern during the OES installation.

We recommend that you choose a pattern installation if one exists for the intended purpose of your server. Options are also provided to install basic and customized OES servers.

The following types of pattern installations are available in OES NetWare:

- Customized NetWare Server
- Basic Netware File Server
- Pre-Migration Server
- Pre-Configured Servers:
  - DNS/DHCP Server
  - exteNd J2EE Web Application Server
  - LDAP Server
  - NetWare AMP (Apache, MySQL, PHP, and PERL) Server
  - NetWare Backup Server
  - QuickFinder Server
  - Network Attached Storage (NAS) Server
  - Novell iPrint Server

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- Apache/Tomcat Server
- Novell Nsure Audit Starter Pack Server
- iSCSI SAN Storage Server
- Management Server
- Novell iFolder Storage Services
- Virtual Office Server

For details on each pattern installation type, see “Choosing a Server Pattern” on page 36 of the *Novell Open Enterprise Server Installation Guide for NetWare* (install-nw.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

Verify Rights for Upgrading to OES NetWare

To upgrade the first NetWare 6.0 or earlier server in an eDirectory tree to OES NetWare, you must have the Supervisor right at the [Root] of the eDirectory tree (normally the Admin user).

If you are upgrading the first NetWare server in an existing NDS/eDirectory tree to OES NetWare, be sure to run Deployment Manager first to prepare the tree so it is compatible with the version of eDirectory that comes with OES NetWare.

This requires access to a server with a Read/Write replica of the Root partition.

If you already have NetWare 6.5 installed, you do not need to run Deployment Manager.

For security reasons, you might want to create one or more subcontainer administrators with sufficient rights to install or upgrade additional OES NetWare servers, without granting them full rights to the entire tree.

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A subcontainer administrator needs the following rights to install or upgrade a NetWare server in the tree:

- Supervisor right to the container where the server will be installed
- Read right to the Security container object for the eDirectory tree
- Read right to the NDSPKI:Private Key Attribute on the Organizational CA object, which is located in the Security container
- Supervisor right to the W0 object located inside the KAP object in the Security container

These rights are typically granted by placing all administrative users in a group or role, and then assigning the above rights to the group or role.

Some of the products that you can select to install with OES NetWare require schema extensions of their own.

Currently, only an administrator with rights at [Root] can extend the schema of an eDirectory tree; a subcontainer administrator does not have sufficient rights.

One way to work around this is to have a root administrator install an OES NetWare server with all products selected. This takes care of extending the schema for every possible server configuration.

Subcontainer administrators can then install or upgrade subsequent OES NetWare servers without worrying about schema extensions.

However, an easier method for extending the schema for OES products and services is to run the Schema Update task in Deployment Manager. This task extends the schema for the OES products you select for both the NetWare and Linux platforms.

By default, the first three servers installed in an eDirectory partition will automatically receive a replica of the partition.

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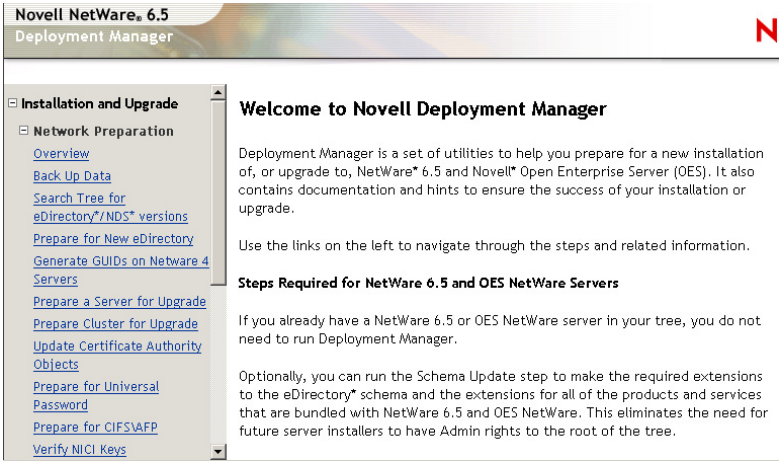
To install a server into a partition that does not already contain three replica servers, you must have either the Supervisor rights at the [Root] of the tree or administrative rights to the container in which the server holding the partition resides.

Prepare the Network with Deployment Manager

Deployment Manager is a set of utilities to help you prepare for a new installation of, or upgrade to, Novell Open Enterprise Server:

Figure 1-9



It also contains documentation and hints to ensure the success of your installation or upgrade.

Deployment Manager provides easy access to a number of tasks you might need to perform as you prepare your network for OES server installations or upgrades.

For example, before you introduce an OES NetWare server into an existing network (through a new installation or by upgrading an older server), you should run the Novell Deployment Manager to ensure that your network—and eDirectory in particular—is properly prepared.

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If you already have a NetWare 6.5 or OES NetWare server in your eDirectory tree, you do not need to run Deployment Manager.

Because you are upgrading to OES NetWare from a NetWare 6.5 server in this course, you will not be using Deployment Manager in any exercises.

Deployment Manager is primarily a NetWare server deployment tool, but it can also be used to prepare eDirectory when you are installing the first OES Linux server into a tree containing no NetWare 6.5 or OES NetWare servers.

The following lists the options available in Deployment Manager:

- **Network Preparation**
  - Back Up Data
  - Search Tree for eDirectory/NDS Versions
  - Prepare for New eDirectory
  - Generate GUIDs on NetWare 4 Servers
  - Prepare a Server for Upgrade
  - Prepare Cluster for Upgrade
  - Update Certificate Authority Objects
  - Prepare for Universal Password
  - Prepare for CIFS/AFP
  - Verify NICI Keys
  - Schema Update
- **Install/Upgrade Options**
  - Install NetWare 6.5
  - Automate an Installation
  - Upgrade to NetWare 6.5
  - Consolidate or Migrate Servers
- **Post-Install**
  - Create Additional Volumes
  - Install NetWare 6.5 Products

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- Use DSREPAIR
- Install/Upgrade Cluster
- Remove Deployment Manager

For details on using Deployment Manager, see “Prepare the Network with Deployment Manager” on page 18 of the *Novell Open Enterprise Server Installation Guide for NetWare* (install-nw.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

Prepare the Computer

To prepare your existing server for the OES NetWare operating system, complete the following tasks:

- **Back up the NetWare server files.** Make at least one backup of your NetWare server files, including files on the DOS partition. Do not attempt an upgrade without a backup.
- **Log out users prior to upgrading.** We recommend that you log all users off the server before upgrading it.
- **Prepare application files prior to upgrading.** Some applications require that you perform certain actions prior to upgrading.

  For example, if the server is running ZENworks for Servers 2, you must install ZENworks for Servers 3 prior to upgrading the server to OES NetWare.

  Any applications, products, or services (such as virus scan software or backup software) running on the server to be upgraded should be shut down before beginning an upgrade.
- **Verify a valid DOS partition.** Your NetWare server uses the DOS partition to start the computer and load NetWare.

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Many of the existing NetWare startup files will be replaced with new OES NetWare files. In addition, the DOS partition must exceed the minimum amount of available space to accommodate new OES NetWare files.

If the DOS partition does not have enough available space, you cannot upgrade the server. You must create a new DOS partition and install a new server.

For details on creating a new DOS partition, see “Creating and Formatting a Boot Partition” on page 29 of the *Novell Open Enterprise Server Installation Guide for NetWare* (install-nw.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

If your computer does not meet the minimum requirements, you might try using the NetWare Migration Wizard to migrate data to another computer.

For complete information on the NetWare Migration Wizard, see the *Novell Server Consolidation and Migration Toolkit 1.1 Administration Guide* (scmt11.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

- **Locate NetWare license files.** If you are upgrading to OES NetWare from a version of NetWare earlier than NetWare 6.5, you must purchase new license files from your Novell Authorized Reseller.

  Make sure the license files are in a location where they can be accessed by the NetWare Install program, such as on a diskette or on the server’s DOS partition.

  The NetWare Install program automatically updates the licenses.

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If you are upgrading to OES NetWare from any version of NetWare 6.5 (from the original release to SP4) and you have upgrade protection or maintenance on your NetWare 6.5 licenses, you can continue to use your existing license files.

If you want to increase the number of users on your network, or if you do not have an upgrade protection or maintenance agreement for NetWare, you must purchase new OES licenses.

The NetWare Install program detects the installed license during the upgrade and prompts you to either use the current license or install a new license.

Start an In-Place Server Upgrade

While there are several methods of performing an upgrade to OES NetWare, in this course we introduce you to the in-place upgrade method.

When you perform an in-place upgrade to OES NetWare, both the operating system and eDirectory are upgraded. In addition, only the NetWare products or components that are currently installed are upgraded.

Other Novell products that you might have purchased or installed separately (for example, GroupWise® or ZENworks) are not upgraded.

Additionally, the Enterprise server is migrated to the Apache 2 Web server when you upgrade to OES NetWare. During the upgrade, the existence of the Enterprise server is verified and, if it exists, information in the Enterprise server's config files is migrated to the Apache 2 server's config files.

After the Apache 2 Web server is installed, the Enterprise server is automatically removed.

If you are performing an upgrade, several components are already selected. These are the components currently installed on the server.

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Leaving the installed components checked reinstalls the products. Unchecking an installed component does not uninstall the product.

If you attempt to install a new server into your tree at the same time you upgrade another server in the tree to OES NetWare, you might have difficulty logging in to the server being upgraded until the other server's installation is complete.

To begin an in-place upgrade to OES NetWare with CDs, do the following:

1. From the NetWare server you want to upgrade, insert ***Novell OES NetWare Installation CD 1*** (Operating System).
2. From the system console prompt, verify that the CD has automounted as a NetWare volume by entering **volumes**.
3. (Conditional) If the CD does not automount, do one of the following:
   - On a NetWare 6.5 server, at the system console prompt, enter **LOAD CDDVD.NSS**.

     or
   - On a NetWare 6.0 server, at the system console prompt, enter **LOAD CD9660.NSS**.

     or
   - On a NetWare 5 server, at the system console prompt, enter **LOAD CDROM.NLM**.

   If the CD still does not mount, reboot the server.
4. From the server GUI console, select **Novell**; then select **Install**.
5. From the Installed Products page, select **Add**.
6. When the Source Path page appears, browse to the location of your OES NetWare software.
7. Select the **product.ni** file; then select **OK**.
8. Verify that the Source Path window displays the correct path; then select **OK**.

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9. From the Open Enterprise Server and JReport Runtime License Agreement dialogs, select **I Accept**.

   At this point, NetWare performs a health check of your server to determine if an upgrade can proceed without problems.

   If the health check is completed without any warning or failure states, the Backup Server Files dialog appears, allowing you to continue with the upgrade.

   If a failure state occurs, a summary of the checks that were run is displayed indicating a Success, Warning, or Failure status for each check that was run.

   A Success or Warning status allows the upgrade to continue. A Failure state stops the upgrade until you resolve the problem.

10. To view the detailed health check log, select **View Log**.

11. To continue the upgrade, select **Next**.

From this point forward, follow the dialogs and prompts to complete the upgrade to an OES NetWare server (see “Complete the OES NetWare Server Upgrade” below).

Complete the OES NetWare Server Upgrade

During the OES NetWare server upgrade, several configuration dialogs are displayed. The following topics provide guidelines for some of the main dialogs:

- Back Up Server Files
- Components
- eDirectory Login and Summary
- Novell Modular Authentication Service (NMAS)

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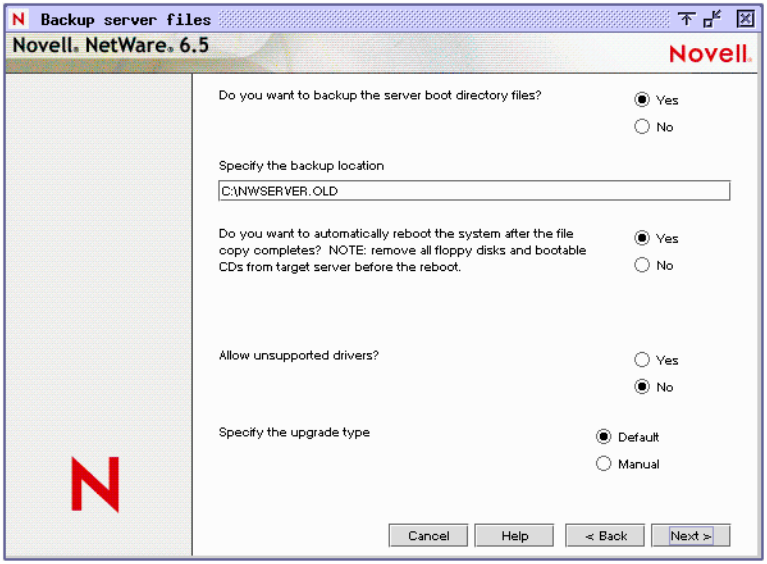
Back Up Server Files

This dialog lets you specify whether to back up your server files:

Figure 1-10



It also lets you choose whether to automatically reboot the server after the file copy is complete and lets you select a Default or Manual installation.

If you selected Yes to back up files, make sure that the drive you specify as the location for the backup is a valid drive on the server.

A Default upgrade automatically detects drivers and upgrades the server to NetWare 6.5 with default settings. A Manual upgrade lets you manually configure your drivers and the default settings used in the Default upgrade.

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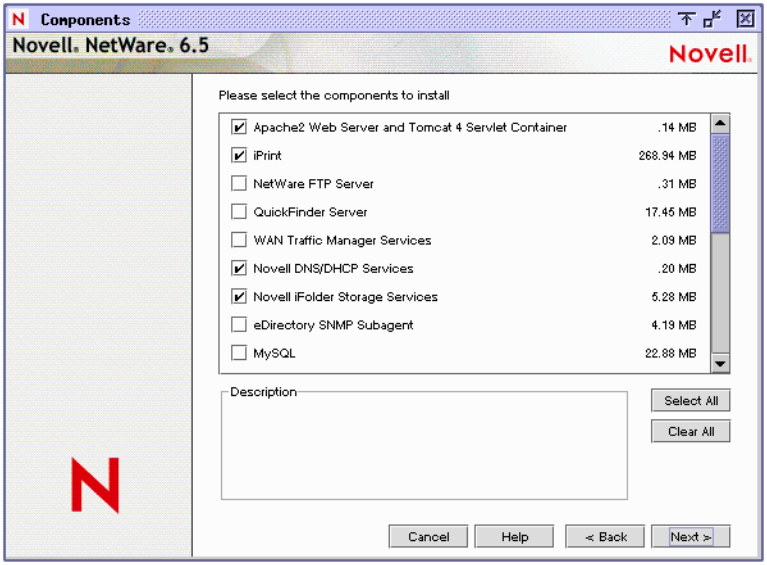
Components

After the file copy is complete, the Components page appears. You can choose which additional OES NetWare components to install:

Figure 1-11



To view a description of a component, select the component name.

Because you are performing an upgrade, several components are already selected. These are the components currently installed on the server.

Leaving the installed components checked reinstalls or upgrades the products. Unchecking an installed component does not uninstall the product; it leaves the current version of the component installed.

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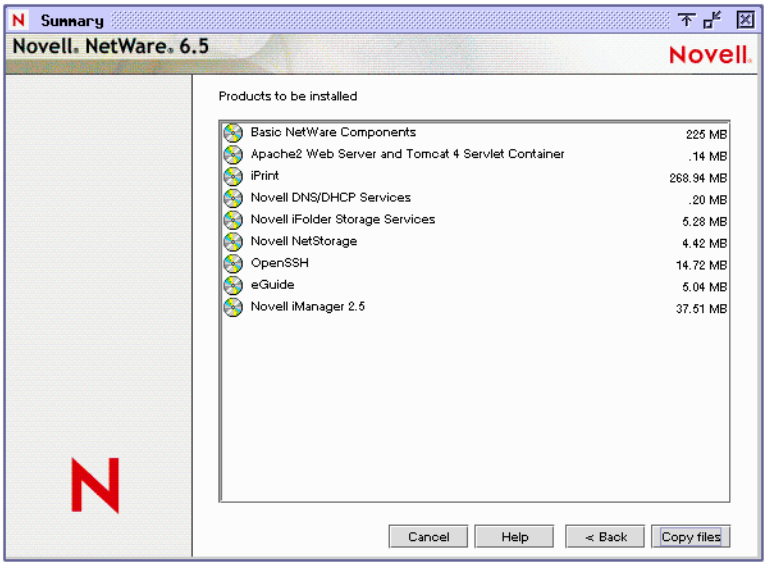
After selecting the components on the Components page that you want to install, a Summary screen appears displaying the names of the selected products and the disk space (in MB) required to install them:

Figure 1-12



If you want to change your product selection, select Back and make the necessary changes.

After verifying the product names and space requirements, select Copy Files.

The iManager installation might take up to 15 minutes to complete. During iManager installation, the page will not change.

If you see a message stating that there is a file conflict, select the file overwrite option that you prefer; then select OK.

The system proceeds to copy files for a few minutes, and then reboots.

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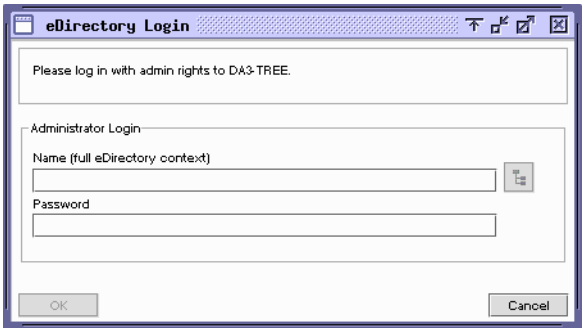
If you selected Manual during installation, your device drivers are detected and you are presented with a screen or screens from which you can modify these settings.

If you selected Default during installation, the system continues to copy files after the reboot.

eDirectory Login and Summary

When the post-reboot file copy is completed, a GUI screen appears and you are prompted to log in to eDirectory:

Figure 1-13



Type your name and password in the fields provided; then select **OK**.

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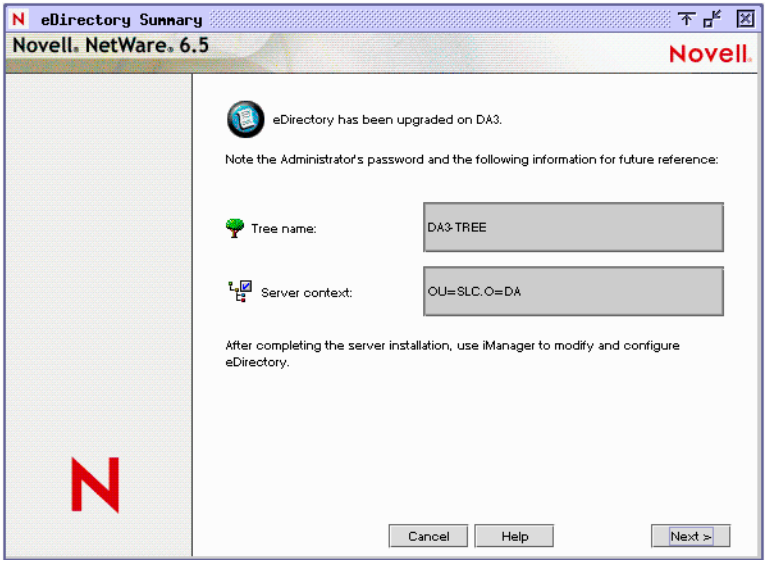
An eDirectory Summary page appears:

Figure 1-14



Verify that the information on the eDirectory Summary page is accurate; then record the Admin password and any other relevant information and select **Next**.

Novell Modular Authentication Service (NMAS)

NMAS™ server components are installed automatically when you run the NetWare 6.5 installation program. However, you need to select the login methods you want to install.

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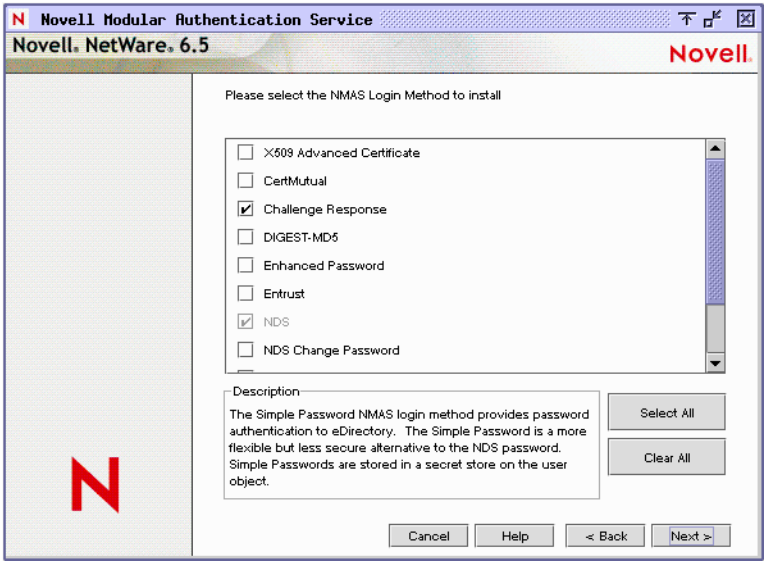
The Novell Modular Authentication Service page lets you select the login methods that you want to install into eDirectory:

Figure 1-15



When you select a login method, a description of the component appears in the Description box.

For more information on login methods, see "Managing Login and Post-Login Methods and Sequences" on page 17 in the *Novell Modular Authentication Services (NMAS) 2.4 Administration Guide* (admin_nmas.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

The NDS login and Challenge-Response methods are installed by default. If you want to install all the login methods in eDirectory, select **Select All**. If you want to clear all selections (except the two default methods), select **Select Clear**.

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The NMAS client software must be installed on each client workstation where you want to use the NMAS login methods. The NMAS client software is included with the Novell Client™ software.

Complete Post-Installation Tasks

After installing or upgrading to Novell OES NetWare, you should install the latest software updates. You can also install additional products or services and configure them to work in the new environment.

Chapter 4 in the *Novell Open Enterprise Installation Guide for NetWare* (install-nw.pdf) covers the post-installation tasks such as the following:

- Installing NetWare licenses
- Updating NSS volumes
- Installing or updating Novell Client software
- Installing product updates
- Installing additional products
- Deploying eDirectory 8.8

You can access the guide from http://www.novell.com/documentation/oes, or from the OES_Docs directory on your *3077 Course CD*.

We will cover some of these post-installation tasks throughout the course when discussing an appropriate topic (such as NSS volumes).

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Exercise 1-1 Upgrade to Novell OES NetWare

In this exercise, you perform an in-place upgrade of your NetWare 6.5 SP1 server (DA2) to OES NetWare SP2 (NetWare 6.5 SP5).

Exercise 1-1 Upgrade to Novell OES NetWare is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 1-2.

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Summary

Objective	Summary
1. Describe Novell Open Enterprise Server (OES)	In this objective you learned that Novell Open Enterprise Server (OES) is a powerful combination of products and technologies that run on both the NetWare and SUSE Linux Enterprise Server (SLES) 9 operating systems. You can deploy OES services on either OES NetWare® (NetWare 6.5 SP3 or later) or SUSE® Linux Enterprise Server 9 (SLES 9) server. You can choose to install OES on a new server or upgrade an existing NetWare 6.5 or SLES 9 server to run OES services.
2. Decide Which OES Services to Install	In this objective you learned that as you plan which services to install on which OES platform, you probably have a number of questions. Finding the answers to the following questions helps when deciding which OES services to install: ■ What Services Are Included in OES? ■ Which Services Do I Need? ■ Which OES Platform Is Best for My Services?

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Objective	Summary
3. Plan Your OES Implementation	In this objective you learned that, once you understand the components available in Novell OES and have decided which services to install, you are ready to begin planning your OES implementation. The following are key planning steps you should follow to successfully implement Novell OES: ■ Plan for eDirectory ■ Prepare Your Existing eDirectory Tree for OES ■ Identify a Purpose for Each Server ■ Evaluate Server Requirements ■ Evaluate User Restrictions and Linux User Management ■ Consider Coexistence and Migration Issues ■ Review Your Installation Options Before You Start
4. Purchase and License Novell OES	In this objective you learned that as part of your plan to implement Novell OES, you need to understand the following about purchasing and licensing Novell OES: ■ How to Get OES Through Upgrade Protection ■ How to Purchase OES ■ Novell OES Licensing

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Objective	Summary
5. Upgrade to Novell OES NetWare	In this objective you learned that, if your migration plans include an upgrade to OES NetWare, you need to do the following: ■ Review Upgrade Guidelines Options for OES NetWare ■ Check System Requirements ■ Determine the Services to Install ■ Verify Rights for Upgrading to OES NetWare ■ Prepare the Network with Deployment Manager ■ Prepare the Computer ■ Start an In-Place Server Upgrade ■ Complete the OES NetWare Server Upgrade ■ Complete Post-Installation Tasks

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SECTION 2 Manage an OES Linux Server

In this section, you learn how to perform administrative tasks on an OES Linux server.

Objectives

1. Manage an OES Linux Server from the KDE Desktop
2. Perform Administrative Tasks with YaST
3. Manage an OES Server from a Bash Shell
4. Manage the Linux File System

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Introduction

Once you have OES Linux installed, performing administrative tasks can be a little challenging as you become familiar with the Linux file system and administrative tools.

Although many of the details might be new to you, the general administrative concepts are still the same as managing any other operating system.

In this section, you are introduced to some of the basic tools and interfaces you can use to manage your OES Linux server from the KDE desktop.

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Objective 1 Manage an OES Linux Server from the KDE Desktop

One of the most used graphical desktop environments in Linux is KDE. This desktop environment is installed by default during the installation of OES Linux.

To use the KDE desktop to manage Novell OES servers effectively in this course (and in a production environment), you need to know the following:

- What the root User Is
- How to Log In
- How to Log Out
- How to Shut Down and Reboot the Linux System
- How to Identify KDE Desktop Components
- How to Use the Konqueror File Manager

What the root User Is

As you perform certain tasks in the KDE Desktop, and many system and network related tasks throughout this course, you are required to authenticate as *root*. This is the name of the superuser, the administrator of the system.

Unlike regular users, which may or may not have permission to do certain things on the system, root has unlimited power to do anything: change the system configuration, install programs, and set up new hardware.

If users forget their passwords or have other problems with the system, root can help. The root account should only be used for system administration, maintenance, and repair.

Routinely logging in as root for tasks *not* related to system administration, maintenance, and repair is very risky: a single mistake can lead to irretrievable loss of many system files.

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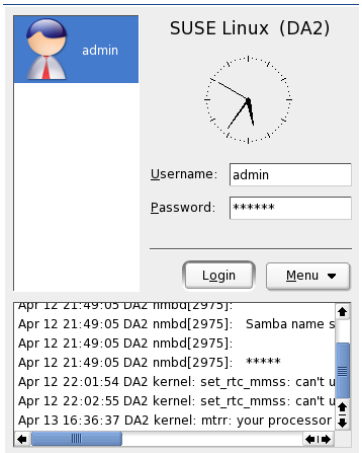
How to Log In

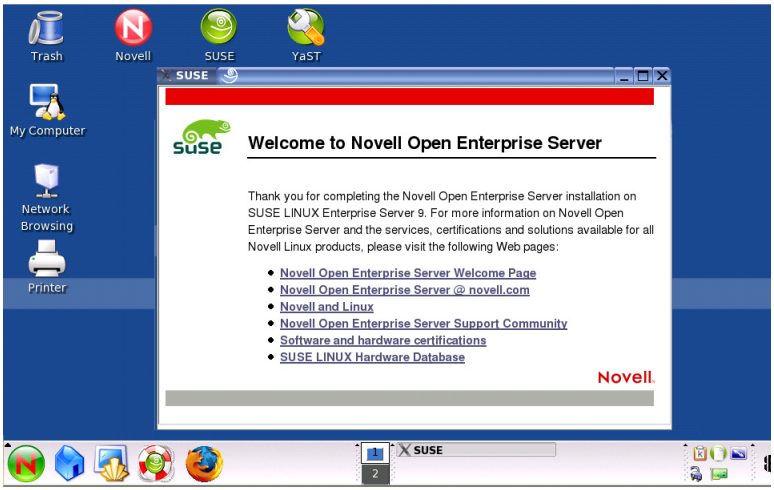
When your OES Linux server is booted and ready for work, the following login dialog appears:

Figure 2-1



After entering a user name (such as **admin**) and password, select **Login**. If the login is successful, the following KDE desktop environment appears with a Welcome dialog:

Figure 2-2



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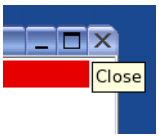
You can read the information or just close the dialog by selecting the **X** button in the top right corner of the window:

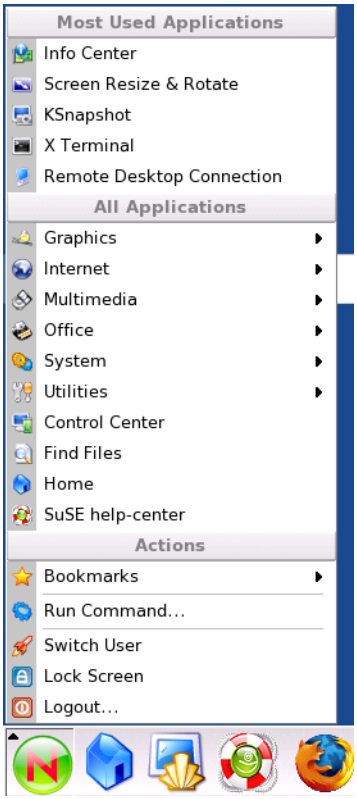
Figure 2-3



How to Log Out

When you are ready to log out of the system, open the KDE menu by selecting the first (left) icon in the bottom panel:

Figure 2-4



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At the bottom of the KDE menu, select the **Logout** entry. You can also right-click on the desktop background and select the same option from the popup menu.

After selecting Logout, a confirmation dialog appears. If you select **Logout** again, you are logged out and the login screen re-appears, allowing you or another person to log in.

How to Shut Down and Reboot the Linux System

If you are at the login screen, you can shut down or reboot your computer by opening the **Menu** menu and selecting one of the following options:

- **Session Type.** You can choose a window manager other than KDE. In this course, we cover only KDE (the default window manager).
- **Restart X Server.** You can restart the program that's responsible for the graphical user interface. Remember, you can perform many administrative tasks without a graphical user interface.
- **Shutdown.** If you select this option, you are asked if you want to shut down or restart your computer:

Figure 2-5

For security reasons, you have to enter the root password because only root is allowed to restart or shut down the computer.

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If you select **Turn off computer** and select **OK**, Linux closes all the (system) programs currently running.

Older computers that do not have power management and cannot switch themselves off can be switched off when the following message appears:

```
Master Resource Control: runlevel 0 has been
reached
```

If you switch the machine off too soon, you could possibly lose data.

You should *always* shut down your computer before you turn it off.

How to Identify KDE Desktop Components

The KDE desktop environment includes the following components:

- The Desktop
- The KDE Control Panel (Kicker)
- The KDE Menu
- Virtual Desktops

The Desktop

On the desktop you see only a few icons. You can start the applications associated with these icons by selecting them once with your left mouse button.

You can move the icons by dragging them with the mouse.

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The KDE Control Panel (Kicker)

The KDE desktop is operated by using the mouse on the KDE control panel (also called the *Kicker*) located at the bottom of the desktop:

Figure 2-6

The following are the most commonly used icons and their functions (from left to right):

- **Green button with red "N":** Menu of all *configured* programs and functions (not of all programs and functions installed on the machine). This menu is called the *KDE menu*.
- **Blue house:** A Konqueror file browser with the home folder of the logged-in user.
- **Shell in front of monitor:** A terminal window in which to type commands directly.
- **Lifesaver with a chameleon head:** The SUSE Help Center.
- **Globe with gear wheel teeth:** The Konqueror web and file browser.
- **"E" with letter:** The KMail e-mail program.
- **The white and gray box:** Virtual desktops.
- **The empty area right of the virtual desktops:** Task Manager area.
- **Clipboard with "k":** Clipboard.
- **Loudspeaker:** A sound mixer.
- **Sheet with "i":** SuSEwatcher for automatic updates.
- **Computer card:** SuSEplugger for plug and play.
- **Clock:** Current time.

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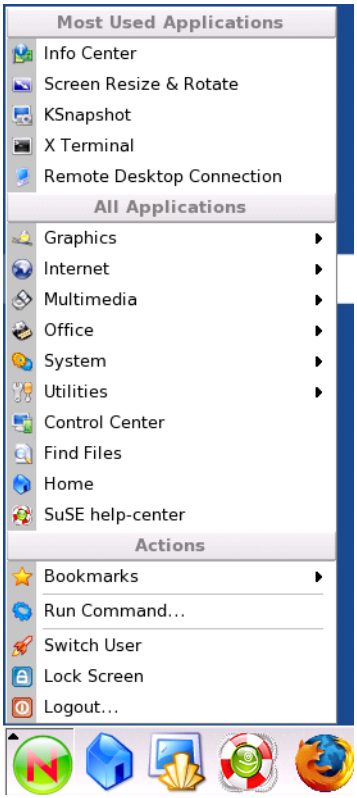
The KDE Menu

Programs are normally started from the KDE menu. You can select the KDE menu button to open the KDE menu:

Figure 2-7



This menu consists of the following sections:

- **Most Used Applications.** As indicated by the name, this section lists the five most frequently used applications. Accordingly, the listed entries can change from time to time.
- **All Applications.** This section features an overview of various applications sorted by subjects (such as **System**).

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- **Actions.** This section provides a command line interface, an overview of the bookmarks, an option for locking the screen, and the option for logging out.

A submenu in the KDE menu is marked by a small black arrow in the right-hand corner. To open a submenu, move the mouse cursor over the menu entry. To start a program, select the corresponding entry once with the left mouse button.

Virtual Desktops

If you are working with several programs concurrently, the screen can quickly become cluttered with open windows. In Linux, you can bring order to this chaos by changing to another (virtual) desktop. You can switch between the various desktops via the control panel.

By default, two virtual desktops are configured. In the KDE control center, you can increase the number of usable virtual desktops up to sixteen.

Every virtual desktop can host a virtually unlimited number of applications. Using these virtual desktops, you can easily organize your work.

How to Use the Konqueror File Manager

You can perform many file system tasks by using the KDE Konqueror program. To start Konqueror, select the ***blue house*** icon in Kicker.

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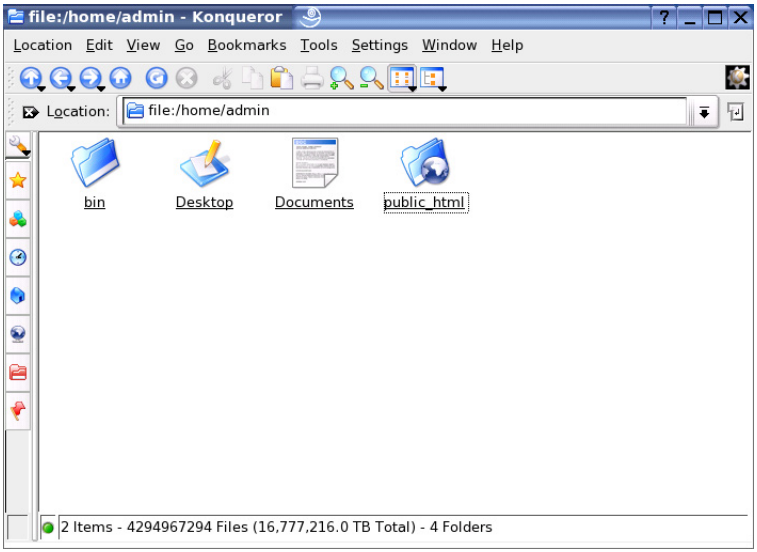
The following appears:

Figure 2-8



To navigate quickly through the file system, activate the *navigation panel* (select **Window > Show Navigator Panel**), which splits the main window and displays the directory tree.

The icon with the blue house on the navigation panel displays the directory tree starting from the user's home directory. The icon with the folder displays the directory tree starting from the root directory.

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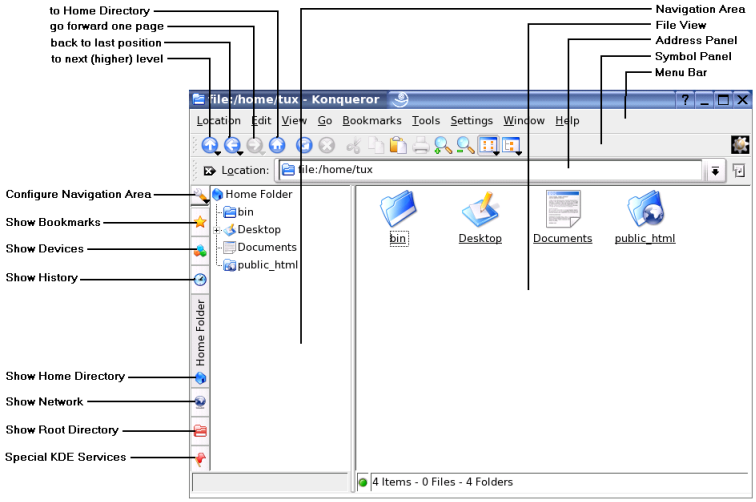
The Konqueror window is divided into three sections with the following features:

Figure 2-9



The top section contains a menu bar, a toolbar, and an address panel. The bar to the left is the preset navigation panel, which serves primarily for navigation and orientation.

The navigation area is split into a right and left window (after selecting the blue house or folder icon). You can use the left window for quicker navigation through the file system tree.

Once you select a directory in the left window, the directory contents (file view) are displayed in the right window.

You can use several methods to navigate in the file system. The three arrows on the left side of the toolbar represent the simplest way. The current position can be seen in the text window of the URL panel (in the above example, **/home/tux/**).

If you select the arrow pointing upwards, you will move from the current directory to the next highest directory (from **/home/tux/** to **/home/**). The arrow pointing to the left returns you to the previously visited location. You can move forward again with the right arrow.

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You can open a directory and view its contents by selecting the directory in the file view. If you select a normal file, KDE tries to open it or starts a program to open it.

Selecting the house icon in the toolbar takes you directly to your own home directory (such **/home/tux/**).

The second method of navigating is provided by the navigation area. If you select a directory in the navigation area, its contents are displayed in the file view.

You can double-click the directory in the navigation area to open it and view all subdirectories in it. Double-click the directory again to close it.

If you prefer a detailed list that displays information about each file in the tree, activate the tree view by selecting the second icon from the right in the toolbar.

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Exercise 2-1 Manage Your OES Linux Server from the KDE Desktop

In this exercise, you learn some basic OES Linux server management tasks you can perform from the KDE Desktop:

- Log in and log out of the KDE Desktop
- Use the Konqueror file manager
- Use KDE system information and help utilities
- Configure the KDE desktop

Exercise 2-1 Manage Your OES Linux Server from the KDE Desktop is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 2-2.

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Objective 2 Perform Administrative Tasks with YaST

YaST is a graphical Linux-based utility that greatly simplifies the installation and configuration of components on SUSE LINUX Enterprise Server 9 (SLES 9) servers. The name YaST stands for *Yet another Setup Tool*.

Novell has integrated the OES Linux installation with the SUSE YaST program.

To understand how YaST works with OES Linux, you need to know about the following:

- YaST and OES Linux Installation
- YaST and OES Linux Configuration
- Adding Novell OES Services to OES Linux
- The Role of SuSEconfig

YaST and OES Linux Installation

As you install OES Linux, the YaST utility launches at the second step in the process. YaST then guides you step by step through the installation, much the same as the GUI part of the NetWare installation.

The Novell OES installation uses YaST to let you install SLES 9 and OES services at the same time. Or you can install the SLES 9 components, and then use YaST later to install selected OES services.

To understand more about the installation options, you need to know the following:

- OES Linux Installation Options
- SLES 9-Only Installation Options

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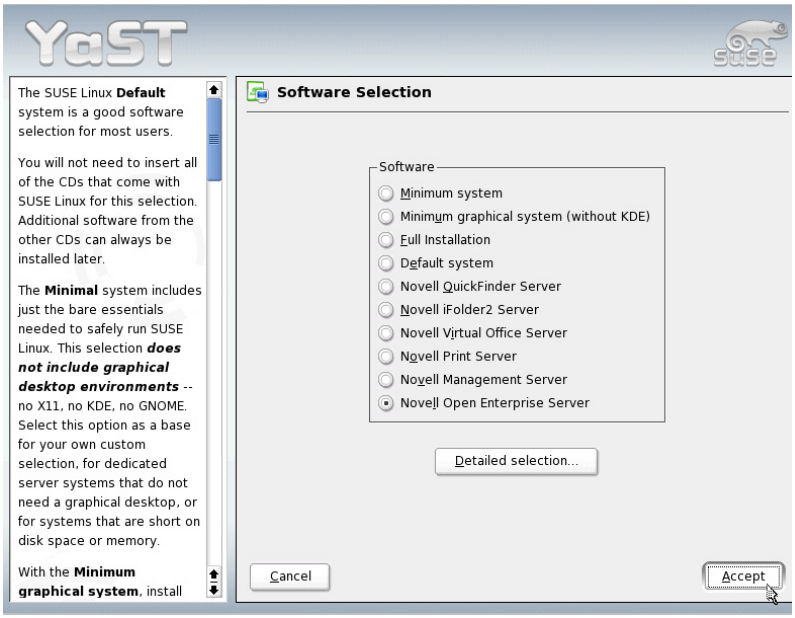
OES Linux Installation Options

The software selection part of the YaST installation displays the following:

Figure 2-10



Notice that the default selection is to install Novell Open Enterprise Server. Selecting this option installs all OES components except the following:

- Novell Cluster Services
- Novell iFolder 2.*x*
- Novell Storage Services (NSS)

If you require any of these three services, Novell recommends that you install them after the initial OES installation is complete.

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If you want to install a specialized OES Linux server, you can select from the following pattern installations:

- Novell QuickFinder Server
- Novell iFolder2 Server
- Novell Virtual Office Server
- Novell Print Server
- Novell Management Server

You can also use YaST to upgrade an existing SLES 9 server to OES Linux.

For details on each of the Novell OES installation options see “Decide What Type of Server You Are Installing” on page 10 of the *Novell Open Enterprise Server Installation Guide for Linux* (install-linux.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

SLES 9-Only Installation Options

The first four items in the YaST Software Selections list are the SLES 9-only options. If you select one of these options, you will not be installing any of the Novell OES components.

For details on each of the SLES 9 installation options see “Decide What Type of Server You Are Installing” on page 10 of the *Novell Open Enterprise Server Installation Guide for Linux* (install-linux.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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YaST and OES Linux Configuration

Although you use YaST to install OES Linux, it has an equally important role as a system management and configuration tool.

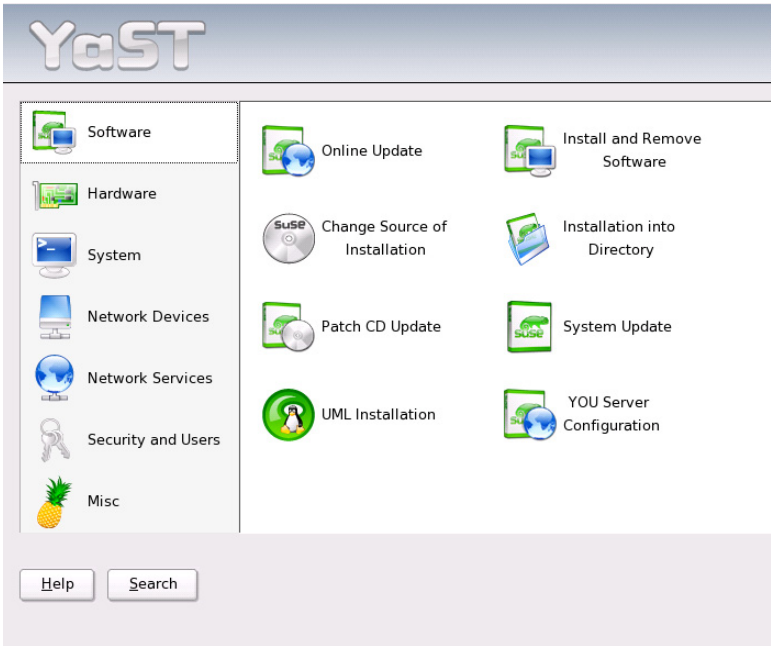
You can use YaST to configure various services, to install software, to configure hardware, to manage users, and to complete many other administrative tasks.

To perform basic administrative tasks with YaST, you need to know how to do the following:

- **Start YaST with a GUI interface.** You can start YaST by selecting the **YaST** icon from the desktop and then entering the root ***password*** (if you are not already logged in as root).

  After authenticating, the following appears:

Figure 2-11



This is the main dialog of YaST, also known as the *YaST Control Center.*

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From here you select a category on the left (such as Software or System) and a module on the right (such as Online Update) to configure and manage your system from a GUI interface.

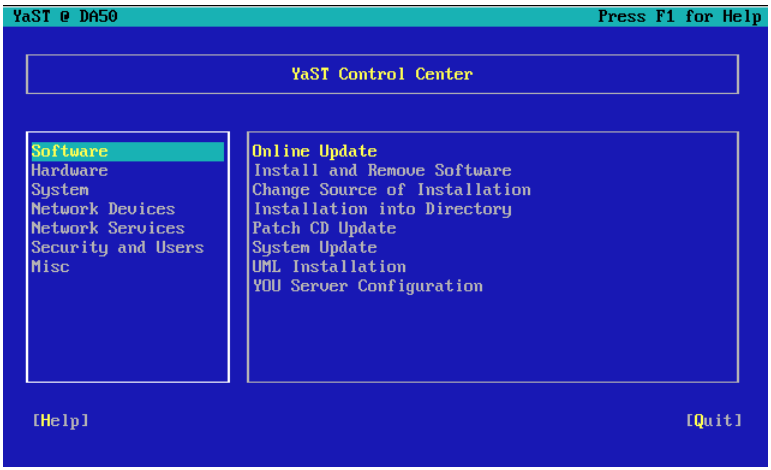
When you finish making changes with a YaST module, YaST uses backend services such as SuSEconfig to implement the changes in the system.

- **Start YaST with a text interface (ncurses)**. As root you can run YaST without a graphical user interface by entering **yast**. This starts the *ncurses* interface.

  If there is no X window server running, the command **yast2** also launches the ncurses interface.

  The following is the YaST Control Center ncurses interface:

Figure 2-12



You can use the Tab key, Up, Down, Left, and Right Arrow keys, or Alt+*letter* to navigate. Except for the navigation, there is no functional difference between the YaST GUI and ncurses interface.

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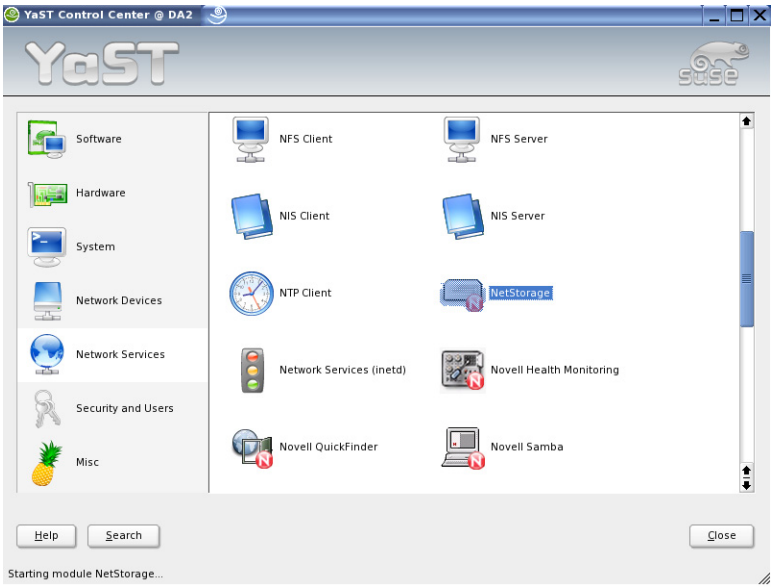
Adding Novell OES Services to OES Linux

You can add Novell OES services to an OES Linux server after installation using YaST. However, *do not* use the Add/Remove Software option in the YaST Control Center to add OES services.

To install additional OES products, select the Network Services option from the YaST Control Center, and then select the option specific to the service you want to add.

For example, if you want to add NetStorage as a service on an OES Linux server, the option to use is in **Network Services > NetStorage**, as shown in the following:

Figure 2-13



This option not only installs all required packages, but it also lets you configure the service.

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For details on the Novell OES post-installation options, see “Installing OES Components on an Existing OES for Linux Server” on page 36 of the *Novell Open Enterprise Server Installation Guide for Linux* (install-linux.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

The Role of SuSEconfig

YaST acts as a front end to programs such as RPM (RPM Package Manager) software management, and to the configuration files of services such as DNS, DHCP, mail, and web services.

When necessary, YaST writes the configuration changes you make directly into the final configuration file.

In many other cases there is an additional intermediate step, in which the information you enter in YaST is first written to a file in the directory /etc/sysconfig/ and then written to its final destination.

This is where the program SuSEconfig becomes important.

SuSEconfig is a tool used in OES Linux to configure the system according to the variables that are set in the various files in /etc/sysconfig/ and its subdirectories.

These files contain variables such as SYSLOGD_PARAMS=“” in /etc/sysconfig/syslog and SMTPD_LISTEN_REMOTE=“no” in /etc/sysconfig/mail.

Some of these variables are used directly (such as in some start scripts). For example, if SYSLOGD_PARAMS is set to “-r,” the daemon that logs system messages is directed to listen on port 514 for system messages from other hosts.

Other variables are used to modify other files.

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For example, if SMTPD_LISTEN_REMOTE is set to “yes,” the variable INET_INTERFACES in /etc/postfix/main.cf is set to “all” by the script /sbin/SuSEconfig and by the scripts in /sbin/conf.d/.

SuSEconfig acts as a back end for YaST and activates the configuration changes you make when using a YaST module.

If you modify files in /etc/sysconfig/ using an editor, all you might need to do is restart a service for the change to take place. However, you might also need to run SuSEconfig.

For this reason, we recommend running SuSEconfig after manually editing files in /etc/sysconfig/.

For details on SuSEconfig, see “SuSEconfig and /etc/sysconfig” on page 274 of the *SLES 9 Administration and Installation Guide* (sles_9_admin_guide.pdf).

Access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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Exercise 2-2 Configure an OES Linux Server with YaST

YaST is the standard GUI tool for performing administrative tasks on an OES Linux server.

Although Novell provides tools such as iManager to perform configuration tasks for OES services, you perform tasks such as installing software and configuring the Linux server through YaST.

In this exercise, you are introduced to YaST by learning how to perform the following tasks from the YaST Control Center:

- View hardware information
- Adjust system time and date
- Install KDE graphics tools
- Add a user account
- View network interface configuration
- Modify security settings

You will use YaST in other exercises to perform tasks such as configuring DNS.

Exercise 2-2 Configure an OES Linux Server with YaST is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 2-24.

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Objective 3 Manage an OES Server from a Bash Shell

Although managing an OES Linux server from the KDE desktop can be a useful and effective method, if you are more comfortable managing a server from a command prompt, the following can help you transition the skills you already have to managing an OES Linux server from a command prompt:

- Virtual Consoles on OES Linux
- Bash Shell on OES Servers
- Bash Shell and OES NetWare
- Common Bash File System Commands
- Bash Command Web References
- NetWare Commands and Linux Equivalents

Virtual Consoles on OES Linux

Because more than one person often uses the same PC, *virtual consoles* (also called *virtual terminals*) were created in Linux. With virtual consoles, you can work in Linux as if you had several terminal screens available at the same time.

You can have up to six virtual consoles (F1–F6) running on your computer. By pressing **Ctrl+Alt+F*x***, you can switch between individual consoles. By pressing **Ctrl+Alt+F7**, you can switch back to your graphical user interface (such as the KDE desktop).

The following lists the standard content of each virtual console:

Table 2-1

Virtual Console	Contents
Ctrl+Alt+F1	Installation dialog
Ctrl+Alt+F2	Shell prompt
Ctrl+Alt+F3	Install log (from installation program)
Ctrl+Alt+F4	System-related messages

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(continued) **Table 2-1**

Virtual Console	Contents
Ctrl+Alt+F5	Shell prompt
Ctrl+Alt+F6	Shell prompt
Ctrl+Alt+F7	X graphical display

You can determine the terminal currently being used from the tty number (tty1–tty6). tty is an abbreviation for *teletype*, which is another word for terminal.

When you switch to a virtual console, a login prompt appears:

```
Welcome to SUSE LINUX Enterprise Server 9 (i586) - Kernel
2.6.4-27-default (tty1).



da5 login:
```

From here you can enter your login name and password. A default shell is started (see “Bash Shell on OES Servers” on 2-26) with a command line prompt (called a *shell prompt* in Linux).

To exit the shell and return to the login, enter **exit**.

Besides using the virtual consoles, you can start a terminal emulation (called Konsole) from your KDE desktop Kicker by selecting the following icon:

Figure 2-14

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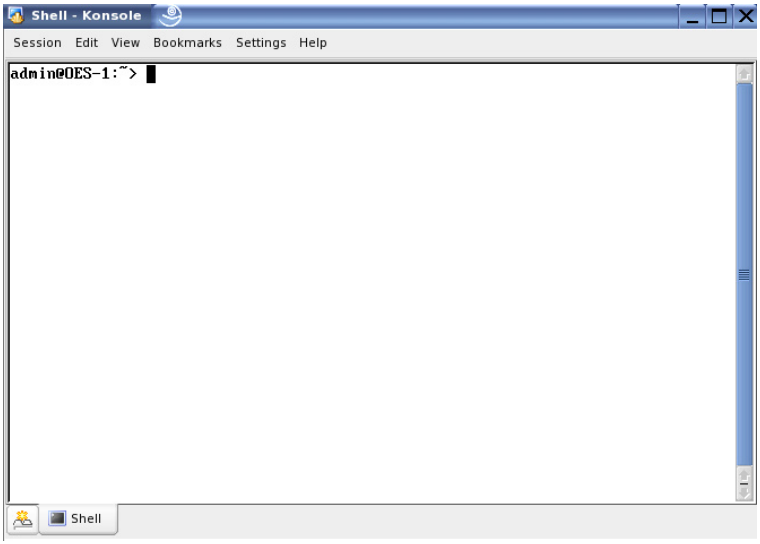
The terminal opens inside a window with a default shell and shell prompt:

Figure 2-15



You can select options from the menus to configure the terminal (such as font and background colors).

When you finish using the terminal window, you can close the window (select the **X** button or select **Session > Quit**).

Bash Shell on OES Servers

To communicate directly with the operating system, you need to use a program that serves as an interface between you and the operating system.

In the UNIX family operating systems (including Linux), this program is called the *shell*.

The shell accepts your entries, interprets them, converts them to system calls, and delivers system messages back to you, making it a command interpreter.

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UNIX has a whole series of shells, most of which are provided by Linux in freely usable versions. The following are examples of some popular shells:

- The Bourne shell (**/bin/sh**)
- The Bourne again shell (**/bin/bash**)
- The Korn-Shell (**/bin/ksh**)
- The C Shell (**/bin/tcsh**)
- The TC Shell (**/bin/tcsh**)

The default shell provided in SUSE LINUX is Bash (Bourne again shell). OES NetWare also provides Bash shell functionality.

To use the Bash shell in Novell OES, you need to know the following:

- How to Start and Exit a Bash Shell
- Completion of Commands and Filenames
- History Function
- Switch to User root (Linux Only)
- Pipe Commands
- Man Pages
- The vi Editor

How to Start and Exit a Bash Shell

The Bash shell can be started by doing the following:

- **OES NetWare.** In OES NetWare, Bash is an NLM file (bash.nlm). You can start Bash from a system console prompt by entering **bash**.

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- **OES Linux.** In OES Linux, the Bash shell is started by default each time you switch to a virtual console (similar to a system console in OES NetWare) or open a terminal window (similar to a Command Prompt window in Windows) from the Linux desktop.

  From a virtual console or terminal window, you can switch to another shell by entering the appropriate command.

  For example, you can switch to the C shell by entering **csh** or **tcsh**; you can switch to the Bash shell by entering **sh** or **bash**.

Unlike most other programs, the shell does not close on its own. You need to enter the command **exit** to return to the previous shell or console.

Completion of Commands and Filenames

The Bash shell supports a function of completion commands and filenames. Just enter the first characters of a command (or a filename) and press the Tab key. The Bash shell completes the name of the command.

If there is more than one possibility, the Bash shell shows all possibilities when you press the Tab key a second time. This feature makes entering long filenames very easy.

History Function

Bash stores the commands you enter in a file so you have easy access to them. You can display the content of the file by entering the command **history**.

You can display the commands stored in the history cache (one at a time) by using the arrow keys. The Up-arrow shows the previous command; the Down-arrow shows the next command. After finding the desired command, edit it as needed; then execute it by pressing **Enter**.

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When browsing the entries of the history in Linux, you can also select specific commands. Typing one or several letters, or pressing PageUp or PageDown, displays the preceding or next command in the history cache beginning with this letter.

If you enter part of the command (not necessarily the beginning of the command), pressing Ctrl+R searches the history list for matching commands and displays them. Searching starts with the last command executed.

Switch to User root (Linux Only)

If you are working with a shell in Linux, you can switch to root by entering the su - command and the root password.

If you want to start a graphical application from the shell, you have to use the sux - command instead.

You can check to make sure you are root by entering **id** or **whoami**. To leave the root administrator shell, you enter the command **exit**.

Pipe Commands

The output of one command can be used as the input for another command by using the pipe symbol (|):

command1* | *command2

For example, you can use the following cat command to output the contents of a file to the screen:

cat hosts

In this example, the content of the hosts file is displayed, and you are returned to the console prompt.

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However, the content of some files is extensive and cannot be displayed all at once on the screen. In this case, you can use a pipe to redirect the output through another command that lets you control the displayed text.

For example, the more command and the less command let you page and scroll through text as it is displayed on the screen:

cat httpd.conf | more

When using the more or less commands, you can continue scrolling (using the Spacebar) until you reach the end of the file and are returned to the shell prompt.

You can also quit the display at any time and return to the shell prompt by typing **q**.

Man Pages

The most important command for getting online help from the Bash shell is *man* (an abbreviation of *manual* or *man page*).

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The following is the first page of the manual pages for the command man (displayed by entering **man man**):

```
man(1)  Manual pager utils    man(1)



NAME
  man an interface to the on-line reference manuals



SYNOPSIS
  man [-c|-w|-tZT device] [-adhu7V] [-m system[,...]] [-L
locale] [-p string] [-M path] [-P pager] [-r prompt] [-S
list] [-e extension] [[section] page ...] ...
  man -l [-7] [-tZT device] [-p string] [-P pager] [-r
prompt] file ...
man -k [apropos options] regexp ...
  man -f [whatis options] page ...

DESCRIPTION
  man is the system's manual pager. Each page
  argument given to man is normally the name of
  a program, utility or function. The manual
  page associated with each of these arguments
  is then found and displayed. A section, if
  provided, will direct man to look only in that
  section of the manual. The default action
  is to search in all of the available sections,
  following a pre-defined order and to show
  only the first page found, even if page exists
  in several sections.
```

The manual pages are organized in the following sections:

Table 2-2

Section	Contents
1	Executable programs and shell commands (user commands)
2	System calls
3	Functions and library routines
4	Device files

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(continued) **Table 2-2**

Section	Contents
5	Configuration files and file formats
6	Games
7	Macro packages and file formats
8	System administration commands

For example, entering the following displays general information about the command more:

man 1 more

Entering the following displays information about the configuration file for the command crontab (which also has the name crontab):

man 5 crontab

If you enter the man command without a section number (such as **man more**), the section 1 manual pages are displayed by default.

You can scroll through the man pages using the Spacebar (one screen forward at a time) or the Up-arrow and Down-arrow keys.

You can quit the man page at any time and return to the command prompt by typing **q**.

All manual pages are available in English and many have been translated into other languages. Because these translations are often incomplete or not maintained, we recommend using the English versions.

If the English man pages are not shown automatically with the command man, you can display the English version of the man page by using the parameter LANG=en_EN.

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The vi Editor

Text editors are still used for many system administration tasks as well as for programming. In Linux, vi stands out as an editor that offers comfortable editing functions and is more ergonomic than many editors with mouse support.

The vi editor makes use of three operating modes: insert mode, command mode, and extended mode. Keyboard keys have different functions in vi, depending on the current mode.

On startup, vi is normally set to the command mode. The first thing to learn is how to switch between the modes:

- **Command Mode to Insert Mode**. To switch from the command to insert mode, choose from the following:
  - Press **A** for append.
  - Press **I** for insert.
  - Press **O** for a new line under the current line.
- **Insert Mode to Command Mode**. To switch from insert to command mode press **Esc**. The vi editor cannot be terminated in insert mode.
- **Command Mode to Extended Mode**. To switch from command mode to extended mode, press the colon (**:**) key. The extended or ex mode is similar to an independent line-oriented editor that can be used for various simple and complex tasks.
- **Extended Mode to Command Mode**. After executing a command in extended mode, the editor automatically returns to command mode. If you decide not to execute any command in extended mode, delete the colon. The editor returns to command mode.

It is not possible to switch directly from insert mode to extended mode without first switching to command mode.

Like other editors, vi has its own procedure for terminating the program. You *cannot* terminate vi while in insert mode. First, exit insert mode by pressing **Esc**.

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Subsequently, you have two options:

1. **Exit without saving**. To terminate the editor without saving the changes, do the following:

   a. Press the colon (**:**) key.

      The colon (:) character appears at the bottom of the vi editor window. You are now in extended mode and any keys you press at this point will appear to the right of the colon.

   b. Enter the following:

      q!

      Entering q indicates you want to quit the program. The exclamation mark (!) causes vi to ignore any changes to the file that is currently open.

2. **Save and exit**. You have several options for saving your changes and terminating the editor.

   - In command mode, enter the following:

     zz

   - To exit the program and save all changes using the extended mode, enter the following:

     :wq

     Pressing the colon switches from command mode to extended mode. Once in extended mode, **w** stands for write and **q** for quit.

Bash Shell and OES NetWare

Although Bash is available on OES NetWare, the following are some differences between Bash on OES Linux and Bash on OES NetWare:

- **Limited functionality on DOS partitions.** Several Bash utilities rely on the existence of inode numbers for proper operation.

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Since files on the DOS partition on OES NetWare do not have inode numbers, these utilities might exhibit strange behavior when accessing files on DOS partitions.

These errors might limit functionality on DOS partitions, but should not result in server abends or data loss.

- **Keyboard control (Ctrl) commands.** The following are Ctrl commands that work differently (or not at all) on OES in OES NetWare Bash:

Table 2-3

Ctrl Command	Difference
Ctrl+Z (Suspend Command)	Does not work and has no effect on processes
Ctrl+C (Interrupt Command)	Works only for processes actively reading from the keyboard or writing to the screen
Ctrl+\ (Quit Command)	Works only for processes actively reading from the keyboard or writing to the screen
Ctrl+D (End of File Command)	Works only for processes actively reading from the keyboard or writing to the screen

Common Bash File System Commands

Common commands for managing the Linux file system include the following:

- **cp.** This command copies files.
- **mv.** This command can be used to move or rename a file.
- **rm.** This command deletes a file.
- **cd.** This command changes the current directory in the file system.

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- **ls.** This command lists the files and subdirectories within the current directory. To see ownership and permissions assigned to files and directories, use **ls** with the **-l** switch.
- **dir.** This command also lists the files and subdirectories within the current directory. To see ownership and permissions assigned to files and directories, use **dir** with the **-o** switch.
- **pwd.** This command prints the current directory.
- **mkdir.** This command makes a directory.
- **rmdir.** This command deletes a directory.
- **more.** This command can be used to pause screen display 1 screen at a time.
- **less.** This command is similar to more; however, it allows you to move either forward or backward through the display.
- **grep.** This command can be used to search for a specific string of text within a file. To do this, enter **grep** ***pattern filename***.

  The grep utility provides many options as well as some derivatives (such as **fgrep** or **egrep**). The most useful command line option is **-i** which forces grep to ignore uppercase and lowercase letters in the pattern you specify.
- **find.** This command can be used to search for a file in the file system.
- **locate**. This command also searches for files in the file system, but uses a database and is much faster than find.

  To build or rebuild the database for locate, **updatedb** is added to cron.daily to be executed daily in the background.
- **cat.** This command prints the content of a file to the screen.
- **tail.** This command prints the last 10 lines of a file to the screen. With the **-f** option, tail works in a forward mode scanning for additions to the specified file.

  For example, the **tail -f /var/log/messages** command is useful for monitoring log files (such as syslog) while troubleshooting a server problem.

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- **head**. This command prints the first 10 lines of a file to the screen.

Bash Command Web References

Besides using the man pages for information about each Bash command, the following are recommended references on the Internet for Bash command information:

- http://www.onlamp.com/linux/cmd/

  Provided as part of the O'Reilly Network, this page provides an alphabetized list of hundreds of Linux commands. Select a command to view information about the command.

- http://www.ss64.com/bash/

  An A-Z index of the Linux Bash command line, each command includes a brief description. You can select a command to display additional information.

NetWare Commands and Linux Equivalents

If you are a NetWare administrator who is transitioning servers and services to OES Linux, you are probably interested in finding Linux counterparts for your favorite NetWare commands.

This objective is designed to help you understand some of the similarities and differences between NetWare and Linux, and to begin working with OES Linux by providing a table of some of the more common NetWare commands and their equivalents in OES Linux.

For some NetWare commands, an OES Linux alternative is not available at the command line but is provided by functionality in OES management tools such as iManager, Novell Remote Manager (NRM), or YaST.

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For a complete listing of Linux counterparts for your favorite NetWare commands, see "Appendix A: Linux Tips for NetWare Administrators" on page 239 of the *Novell OES SP2 Planning and Implementation Guide* (implgde.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

The following lists some of the more common NetWare commands (NW Command) and their OES Linux equivalent (LX Command):

Table 2-4

NW Command	Purpose	LX Command	Notes
BIND	Link a communication protocol to a network board and its LAN driver.	ethtool mii-tool ifconfig	For more information, see the man page associated with each command.
CLS	Clear the console screen and move the console prompt to the top of the screen.	clear	For more information, see the clear man page.
CONFIG	You can view the following:		There is no single equivalent command.
	NetWare server name	hostname cat /etc/*hostname*	For more information, see the man pages associated with the hostname and cat commands. The server name also appears at the shell prompt by default.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
CONFIG (*continued*)	Internal network number (server ID)		There is no internal network number on Linux.
	Server up time	uptime	For more information, see the uptime man page.
	Loaded LAN drivers	lsmod ifconfig	lsmod lists modules loaded in memory, but not the module versions. ifconfig shows the network card configuration.
	Driver version numbers	modinfo dmesg /var/log/boot.msg	For more information, see the man pages associated with each command.
	Hardware settings	lsmod ifconfig	lsmod lists modules loaded in memory, but not the version. ifconfig shows the network card configuration.
	Node (station) addresses	ifconfig	In the future, ip will replace this command.
	External network number of the cabling scheme		

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
CONFIG (*continued*)	Board name	yast	This information is available in **YaST > Hardware > Hardware Information**. For help with YaST, enter **yast -h** at the shell prompt.
	Frame type		
	Networking protocol for each network board		
	Server's eDirectory tree and bindery context	ndsstat	
Dismount	Make a volume unavailable to users.	umount	umount lets you unmount Linux volume mount points. For NCP volumes, use ncpcon.
Down	Execute an orderly shutdown.	init 0 shutdown now	For more information, see the respective man pages.
DSDiag	Document eDirectory; check tree health; diagnose problems.		This functionality is provided through iMonitor.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
DSTRACE	Capture and save background processes and events.	ndstrace	Capture and save background processes and events.
EDIRUTIL	Access all of the eDirectory backend utilities remotely as well as on the server.	edirutil	For more information, enter **edirutil -h**.
EDIT	Create or modify a text file on a boot, DOS, USB, or NetWare partition.	vi vim	For help, enter **vi -h** or **man vim**.
HELP	View descriptions and syntax for commands.	man *command*	
ICE	Import/Export LDIF files; migrate LDAP data; compare and update schemas; load information into eDirectory using a template.	ice	

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
IFCONFIG	Configure network interface parameters.	ifconfig ethtool mii-tool yast	The ifconfig command performs some configuration of network cards, but the changes are not permanent. Instead, use ethtool for modifications on the fly, mii-tool for older cards. Or use YaST to configure network cards permanently.
iMonitor	Monitor eDirectory and the servers it contains using a Web browser.		In a Web browser go to **https://*server*:8009/nds-summary** for NetWare, or **https://*server*:8030** for Linux. iMonitor is also accessible through **iManager > Roles and Tasks icon > eDirectory Maintenance > Repair via iMonitor**

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
INETCFG	Set up and customize your internetworking configuration for IPX, IP, and AppleTalk.	ethtool mii-tool	For more information, see the respective man pages.
LIST DEVICES	Display a list of the storage devices on the server and register new devices with the server's Media Manager database.	cat /dev/*device* ls /dev yast	Linux has many devices, each of which contains information you can view by "walking the /proc file system." You can also display partitions in **YaST > System > Partitioner**, but be careful to exit without making changes.
LOAD	Link loadable modules (NLMs) to the operating system.		Load and run commands are not used on Linux. Generally, to execute files, you simply enter the *filename* or *path*/*filename*. Most services are run from the /etc/init.d directory.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
MAP (DOS workstation)	View drive mappings; create or change network or search drive mappings; map a drive to a fake root directory (for applications that must use a root directory).		The mount command used alone shows both local and remote mount points—the connections between file systems (either local or remote) and a directory on the server. You access the file system (local or remote) by accessing the local directory. Drive letters are not used on Linux.
MAP (DOS workstation) (*continued*)			However, if you install the NCP server, Novell Clients can then map drives to NCP volumes on OES Linux servers.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
Memory	Display the total amount of installed memory that the operating system can address.	top cat /proc/meminfo	There's no memory command per se on Linux. However, the top command gives you a good start with information on what's installed, available, being used by buffers, etc. If you want to see a GUI display, you must be running the KDE graphical interface and use KDE System Guard.
MONITOR	View server statistics and activity.		Most of the information you get traditionally through MONITOR is available in Novell Remote Manager (NRM). To access NRM, browse to **https://*server*:8009** in your Web browser.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
	Server (server name on network tree name)	ndsstat	For more information, see the ndsstat man page. Also see the *OES Novell Remote Manager Administration Guide for Linux*.
	Server Up Time	uptime	For more information, see the uptime man page. Also see the *OES Novell Remote Manager Administration Guide for Linux*.
	Volumes	ncpcon	For more information, see the ncpcon man page.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
MOUNT	Make a volume available to users.	mount (for traditional Linux volumes) nsscon (use the mount option for NSS volumes) nssmu (for the first mount of encrypted NSS volumes after a reboot)	For NSS volumes, in nssmu, select **volumes**, then press **F7**. For encrypted NSS volumes, the nssmu utility is required for mounting the encrypted volume on the first mount following a system reboot because you must enter the encryption password to activate the volume. After that, you can use the mount command in nsscon. The nssmu utility is installed with the Novell Storage Services RPMs.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
NAME	Display the server name.	hostname	The server name appears at the shell prompt by default. You can also view the contents of the /etc/hosts file by entering **cat /etc/hosts** at the shell prompt.
NETSTAT	Monitor the network status.	netstat	For more information, see the netstat man page.
Nslookup	Diagnose DNS setup problems or DNS problems in an application.	dig	The nslookup command has been deprecated on Linux.
NSS	Manage NSS at the command line.	nsscon	The nsscon utility is installed with the Novell Storage Services RPMs.
NSSMU	Manage NSS storage media on a server.	nssmu	The nssmu utility is installed with the Novell Storage Services RPMs.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
NWCONFIG	Manage the server and install additional products.	yast	YaST is the tool for installing OES Linux and OES services. Many configuration parameters are similar to NetWare. For help with YaST, enter **yast -h** at the shell prompt.
NWTrace	Print the route that packets take to the network host.	traceroute	For more information, see the traceroute man page.
PING	Send an Internet Control Message Protocol (ICMP) echo request packet to an IP node on your internetwork.	ping	For more information, see the ping man page.
PROTOCOL	View the protocols registered; register additional protocols and frame types.	ifconfig	For more information, see the ifconfig man page.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
RCONAG6	Allow remote console access to the server.		Novell Remote Manager has a secure console. You can also use SSH (or VNC for GUI access). Telnet is not secure and not recommended.
RCONPRXY	Allow RConsoleJ to access target servers.		Novell Remote Manager has a secure console. You can also use SSH (or VNC for GUI access). Telnet is not secure and not recommended.
RConsoleJ	Remotely control a NetWare server.		Novell Remote Manager has a secure console. You can also use SSH (or VNC for GUI access). Telnet is not secure and not recommended.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
REBUILD	Recover corrupted Novell Storage Services (NSS) pools.	ravsui ravview fsck	The ravsui and ravview utilities are installed as part of Novell Storage Services NSS. Use ravsui to rebuild or verify an NSS pool on Linux that is in a maintenance state. Use ravview to dump specified NSS rebuild or verify files to a human-readable file format. For help with ravsui and ravview, use the **-h** option. For more information about fsck, see the fsck man page.
REINITIALIZE SYSTEM	Enable configuration changes made since the commands in the netinfo.cfg file were executed.	rcnetwork restart	For help, enter **rcnetwork -h** at the shell prompt.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
RESET NETWORK ADAPTER	Reset a network adapter manually.	ifdown ifup	For more information, see the respective man pages.
RESET NETWORK INTERFACE	Restart a logical board that has been shut down using the SHUTDOWN NETWORK INTERFACE command.	ifdown ifup	For more information, see the respective man pages.
RESET SERVER	Bring down the server and then restart it immediately.	init 6 shutdown -r now	For more information, see the respective man pages.
Restart Server	Bring down the server and then restart it immediately.	init 6 shutdown -r now	For more information, see the respective man pages.
RIGHTS	View or modify user or group rights for files, directories, and volumes.	rights	The rights command works only on NSS file systems.
ROUTE	Pass frames (packets) from NetWare through IBM-compatible source route bridges.	route	For more information, see the route man page.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
SCAN ALL	Scan all LUNs of all SCSI adapters in the server or all LUNs associated with a designated SCSI adapter.	iscsi*	iscsi support is not installed by default. After installing, type man iscsi and press the Tab key to view the related commands.
SCAN FOR NEW DEVICES	Scan on LUN0 of SCSI adapters and to register new devices with the Media Manager so that they are available to the operating system.		iscsi support is not installed by default. After installing, type man iscsi and press the **Tab** key to view the related commands. Any EVMS-managed devices that are added after the server boots can be scanned using **iManager > Storage > Scan for Devices**.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
SECURE CONSOLE	Prevent NLMs from being loaded from any directory other than the boot directories; prevent keyboard entry into the operating system debugger; prevent the server date and time from being changed.		The concept of securing the console through a command doesn't exist in Linux. You should always limit physical and remote access to the Linux console and never leave a root session open.
Server			This is roughly equivalent to the running Linux kernel. There is no direct equivalent. Linux boots using the GRUB boot manager. There is no direct connection between Linux and a bootable DOS partition (if present).

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
SET	View and configure operating system parameters.		There is no direct map to the concept of SET parameters in Linux. You can set environment variables using the export command. For more information, see the export man page. To make configurations persistent, you must edit the config file associated with the service.
SPEED	Display the speed at which the processor is running.	cat /proc/cpuinfo	For more information, see the cat man page.
SWAP	Display information about swap files, add or delete swap files, and specify the parameters of swap files.	mkswap swapon swapoff	For more information, see the respective man pages.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
TCPCON	Monitor TCP/IP activity, configuration and statistics information, known routes, and the trap log. Use SNMP to access TCP/IP information in any remote protocol stack supporting the TCP/IP Management Information Base (MIB).	netstat	For more information, see the netstat man page.
TIME	Display date and time, Daylight saving time status, and Time synchronization information.	date	For more information, see the date man page.
TIMESYNC			Timesync is a NetWare time protocol that is compatible with and can be replaced by NTP on a NetWare server.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
UNBIND	Remove a communication protocol from the LAN driver of a network board; disable communication on a specific board.	ifdown	For more information, see the ifdown man page.
UNLOAD	Unload a module that was previously loaded with the LOAD command.		For OES services, use the service's stop script: **/etc/init.d/ *service* stop**
VERIFY	Validate all blocks in an NSS pool.	ravsui verify *poolname* ravview	The ravsui and ravview utilities are installed as part of Novell Storage Services NSS. Use the ravsui utility to find out whether you need to rebuild a pool to correct NSS volume problems. Use ravview to view the output. For help, enter either command with the -h option.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
VERSION	View the file server version, license information, and copyright notice from the System prompt.	uname -a ndsstat	For more information on the uname command, see the uname man page. For help with ndsstat, enter **ndsstat -h**.
VIEW	View the contents of a file from the NetWare server console.	cat	For more information, see the cat man page.
VOLUME	List mounted volumes.	mount	The mount command displays a list of all available file systems, both local and remote. The volume command in the nsscon utility lists the NSS volumes on OES Linux. The nsscon utility is installed with the Novell Storage Services RPMs.

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(continued) **Table 2-4**

NW Command	Purpose	LX Command	Notes
VREPAIR	Correct volume problems on NetWare Traditional volumes; remove name space entries from Directory Entry Tables.	fsck	For more information, see the fsck man page.
XNTPD	Synchronize time with servers that are NTPv3-compliant.	xntpd	For more information, see the xntpd man page.

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Exercise 2-3 Manage OES Linux Servers from a Command Prompt

For experienced network administrators and engineers (especially those managing NetWare servers), knowing how to manage a server from a command prompt or console is critical.

In fact, much of your time on a NetWare server is probably spent entering commands in the system console screen.

In the previous exercises in this section, we've introduced you to some basic management tasks on an OES Linux server that you can perform from the KDE desktop.

However, as with a NetWare server, you might prefer working from a console prompt on an OES Linux server.

This can create challenges because many of the commands or utilities that you use on a NetWare server are not available or work differently from an OES Linux server command prompt.

Table 2-4 in the Integrating Novell Open Enterprise Server for Linux course manual compares NetWare commands to equivalent commands or functionality in OES Linux.

In this exercise, we introduce you to using some basic commands in OES Linux, and then help you compare commands you currently use in NetWare to those you might want to use to accomplish the same task in OES Linux.

You do the following:

- Use the bash shell in OES Linux.
- Perform NetWare tasks in OES Linux.
- Explore additional OES Linux commands.

Exercise 2-3 Manage OES Linux Servers from a Command Prompt is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 2-43.

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Objective 4 Manage the Linux File System

The Linux file system (and, in general, any UNIX system) is considerably different from that of other operating systems.

To successfully manage an OES Linux system, you need to understand the basics of the following topics:

- Linux File System Types
- The Hierarchical Structure of the File System
- FHS (Filesystem Hierarchy Standard)
- Root Directory (/)
- Storage Devices
- File System Mount Points
- User Directories (/home/)
- Filename Restrictions

Linux File System Types

OES Linux supports a number of native Linux file systems. You choose a file system based on the criteria and features that are most important to your enterprise.

No single file system will meet your needs perfectly, but you can determine which will do the best job overall based on criteria such as proven reliability, performance, disk space utilitzation, and application compatibility.

When managing OES Linux, you should have a basic understanding of the relative strengths of three commonly used Linux file systems:

- Ext2
- Ext3
- ReiserFS

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Ext2

Ext2 is the longest lived and most heavily tested of the three most commonly used file systems. Before journaling file systems, ext2 was popular due to its successfully handling system outages to prevent data loss.

Ext2 is not a journaling file system. It uses the e2fsck (file system check) utility to analyze file system data, bring metadata into a consistent state, and write pending files and data blocks to the lost+found directory.

In contrast to journaling file systems, e2fsck analyzes the entire file system and not just the recently modified bits of metadata. This takes significantly longer than checking the log data of a journaling file system.

Depending on file system size, the file system check can take half an hour or more, so it is not desirable to choose ext2 for any server that needs high availability.

On the other hand, due to ext2 not maintaining a journal, it uses significantly less memory and can perform faster than journaling file systems.

Ext3

Ext3 is based on ext2. An ext3 file system can easily be built on top of an ext2 file system. The most important difference is that ext3 supports journaling.

Ext3 offers the following major advantages:

- **Upgrades easily from ext2**. Ext3 is based on the ext2 code and shares its on-disk and metadata formats, so upgrades from ext2 to ext3 are very simple.

  Upgrading from ext2 to ext3 takes only a matter of minutes. It is also very safe, since it does not require recreating an entire file system from scratch.

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- **Customizable Reliability vs Performance**. Other journaling file systems follow the “metadata-only” journaling approach. This means your metadata is always kept in a consistent state but the same cannot be automatically guaranteed for the file system data itself.

  Ext3 is designed to take care of both metadata and data. The degree of “care” can be customized.

  In data=journal mode, Ext3 offers maximum reliability (i.e., data integrity) but slows performance because both metadata and data are journaled.

  In data=ordered mode, ext3 ensures both data and metadata integrity, but uses journaling only for metadata. This is less secure than data-journal mode, but offers a degree of consistency for metadata and data without sacrificing performance.

  In data=writeback mode, ext3 writes the main file system after its metadata has been committed to the journal. This option optimizes performance but can allow old data to reappear in files after crash and recovery while internal file system integrity is maintained.

  Unless otherwise specified, ext3 is configured in data=ordered mode by default.

ReiserFS

ReiserFS, a journaling file system, was introduced as an alternative to the ext2. Its key assets, in comparison with ext2, are better disk space utilization, better disk access performance, and faster crash recovery.

The drawback to ReiserFS is that (like ext3 in data-writeback mode) it optimizes performance by focusing on metadata but can allow the data itself to become unreliable.

OES Linux formats volumes with the ReiserFS file system by default.

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The Hierarchical Structure of the File System

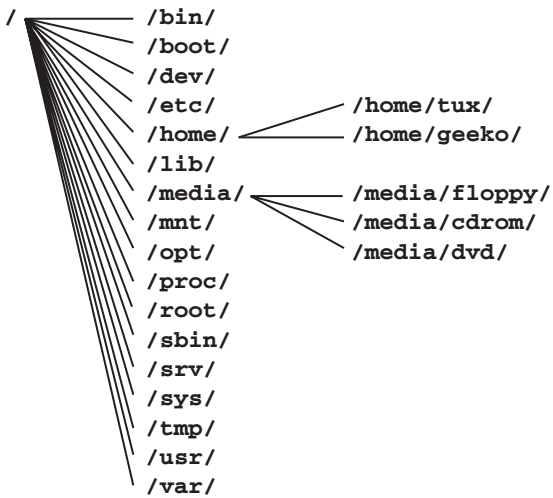
The Linux file system is based on a hierarchical file system that can be depicted in the form of a tree.

This tree is not limited to a local partition. It can stretch over several partitions, which can be located on different computers in a network.

It begins at the root (where the name for the system administrator comes from) and branches out like the branches of a tree.

The following illustrates a typical Linux file system tree:

Figure 2-16



A file in this tree is uniquely defined by its path. A path refers to the directory names that lead to this file.

The separation character between individual directory names is the slash (“/”). The path can be specified in two ways:

- As a *relative path* starting from the current directory
- As an *absolute path* starting from the root of the entire file system tree

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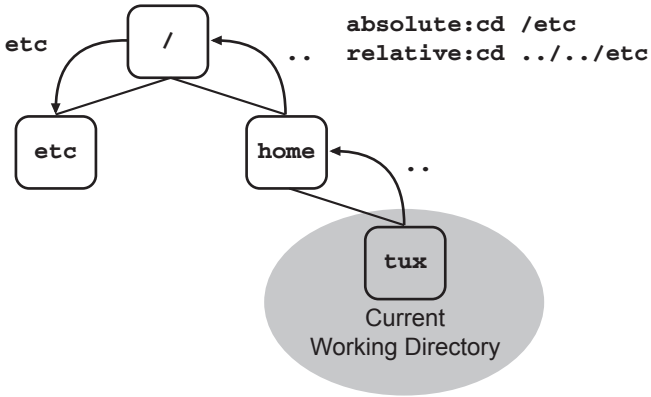
The absolute path always begins with a slash (/), the symbol for the root directory, as in the following:

Figure 2-17



Sometimes it is necessary to specify the absolute path because certain files can only be uniquely addressed in this way. The length of the path cannot exceed 4096 characters, including the slashes.

FHS (Filesystem Hierarchy Standard)

The structure of the Linux file system is described in the Filesystem Hierarchy Standard (FHS). The FHS specifies which directories must be located on the first level after the root directory and what they contain.

The FHS does not specify all details. In some areas it allows leeway for your own definitions. The FHS defines a two-layer hierarchy:

- The directories in the top layer (immediately below the root directory "/").
- As a second layer, the directories under /usr/ and /var/.

Some of the important default FHS Linux directories include the following:

- **/etc.** This directory contains configuration files.

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- **/dev.** This directory contains special link files that reference hardware in the system. For example, /dev/fd0 references floppy disk A. The first IDE hard disk is referenced by /dev/hda.
- **/usr.** This directory contains program files.
- **/var.** This directory contains data such as spool directories, log files, man pages, and other temporary files.
- **/tmp.** This directory stores temporary files created by running applications.
- **/home.** This directory contains user home directories.
- **/root.** This is the root user's home directory.
- **/bin.** This directory contains essential command-line utilities such as vi, rpm, ls, mkdir, more, mv, grep, and tar.
- **/sbin.** This directory contains essential system executables such as fsck, grub, mkfs, arp, fdisk, and ifconfig.
- **/mnt.** This directory is used to mount devices or remote file systems using Samba or NFS. On some Linux distributions (such as Red Hat) it is also used to mount removable devices.
- **/media.** This directory is used to mount removable devices on some Linux distributions (such as SUSE Linux).

You can find information about FHS at http://www.pathname.com/fhs/.

Root Directory (/)

The root directory refers to the highest layer of the file system tree. Normally only directories (not files) are located here. When the system is booted, the partition on which this directory is located is the first one mounted.

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Because the kernel cannot fulfill all the tasks of the operating system, all programs that are run at the system start must be available on this partition (they cannot be located on another partition).

The following directories always have to be on the same partition as the root directory: /bin/, /dev/, /etc/, /lib/, and /sbin/.

Storage Devices

The physical storage devices installed in your computer are managed through device nodes that are stored in the device directory (/dev).

Device nodes are named according to the following convention:

- **/dev/fd0**. First floppy disk drive.
- **/dev/hda**. First IDE hard drive.
- **/dev/hdb**. Second IDE hard drive.
- **/dev/sda**. First SCSI hard drive.
- **/dev/sdb**. Second SCSI hard drive.

The device directory contains a device node not only for every storage device but for every network interface and SCSI controller attached to your system.

For details on Linux devices, see “Dynamic Device Nodes with udev” on page 223 of the *SLES 9 Administration and Installation Guide* (sles_admin.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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File System Mount Points

A directory must exist at the point where you intend to mount the file system. This directory is referred to as the *mount point*. The complete directory structure of the mounted file system can be found beneath this directory.

For example, the / (root) directory is the mount point for the primary file system on a Linux server.

Other file systems such as other hard drive partitions, directories from other computers via the network, or removable media (floppy disks, CD-ROMs, removable hard drives) can be mounted to the / (root) file system at any point.

This accomplishes the same purpose as mapping drives on a Windows server or workstation.

However, on a Linux server or workstation, you do not need to map drives to access other file systems. You simply mount the file system at a specified directory (the mount point).

This makes it much easier to manage file systems from the same file system tree hierarchy.

In most cases, only the user root can mount and unmount directories. Removable media, such as floppy disks and CDs, can be changed by a normal user.

To understand the basics of mounting file systems, you need to know the following:

- How to Mount a File System
- Mount Points for Removable Media (/media/*)
- Mount Point for Temporarily Mounted File Systems (/mnt/)
- Configuration Files for Mounting

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How to Mount a File System

To mount a file system, you enter the command mount, specifying the device file and the directory to which the file system should be mounted.

A file system can be removed again with the command umount. The file /etc/mtab, which is updated by the command mount, shows which file systems are currently mounted.

You can mount file systems in directories that are occupied. The existing contents of these directories, however, will no longer be accessible.

After the file system is removed, this data becomes available again. This feature lets you share certain directories with many computers, and is often used for the home directories of users, which are located centrally on one machine and exported to other computers in the network.

Mount Points for Removable Media (/media/*)

SUSE Linux creates directories such as the following in the directory /media/ (depending on your hardware) for mounting removable media:

- **/media/cdrom/.** Created for mounting CD-ROMs.
- **/media/cdrecorder/.** Created for mounting CDs in a CD burner.
- **/media/dvd/.** Created for mounting DVDs.
- **/media/floppy/.** Created for mounting floppy disks.

Mount Point for Temporarily Mounted File Systems (/mnt/)

The standard directory for integrating file systems is /mnt/. It should only be used for temporary purposes. For permanent mounts, you should create an appropriately named directory.

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In the following example, the hard drive partition /dev/hda7 is mounted at the position /mnt/ in the directory tree using the command mount:

```
da10:~ # mount /dev/hda7 /mnt
```

All files on this partition can now be reached via the directory /mnt/. To remove this partition again, you use the command umount:

```
da10:~ # umount /mnt
```

If you do not include any options with the command mount, the program tries out several file system formats. If you want to specify a specific file system, use the option -t.

If the file system format is not supported by the kernel, the command is aborted, and you receive an error message. In this case, you must compile a new kernel that supports the file system format.

Configuration Files for Mounting

The file systems and their mount points in the directory tree are configured in the file /etc/fstab. This file contains 1 line with 6 fields for each mounted file system.

The lines look similar to the following:

```
Field 1    Field 2       Field 3  Field 4         Field 5 Field 6

/dev/hda2  /             reiserfs acl,user_xattr  1       1
/dev/hda1  swap          swap     pri=42          0       0
devpts     /dev/pts      devpts   mode=0620,gid=5 0       0
proc       /proc         proc     defaults        0       0
usbfs      /proc/bus/usb usbfs    noauto          0       0
sysfs      /sys          sysfs    noauto          0       0
/dev/cdrom /media/cdrom   subfs    fs=cdfss,ro,procuid,nosuid,nodev,exec,
/dev/fd0   /media/floppy  subfs    fs=floppyfss,procuid,nodev,nosuid,sync
```


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Each field provides the following information for mounting the file system:

- **Field 1.** The name of the device file.
- **Field 2.** The mount point—the directory to which the file system should be mounted. The directory specified here must already exist.
- **Field 3.** The file system type (such as ext2 or reiserfs).
- **Field 4.** The mount options. Multiple mount options are separated by commas (such as **fs=cdfss,ro,procuid,nosuid**).

  For example, the options **ro** and **nodev** for the CDROM drive (/dev/cdrom) mean that the drive is read only (**ro**) and that device files on the CD are not interpreted as such by the file system (**nodev**).
- **Field 5.** Indicates whether to use the backup utility dump for the file system. **0** means no backup.
- **Field 6.** Indicates the sequence of the file system checks (with the **fsck** utility) when the system is booted:
  - **0:** file systems that are not to be checked
  - **1:** the root directory
  - **2:** all other modifiable file systems

While /etc/fstab lists the file systems and their mount points in the directory tree, the /etc/mtab file lists the file systems currently mounted and their mount points.

The mount and umount commands modify the /etc/mtab file and affect the state of mounted file systems.

The kernel also keeps information for /proc/mounts, which lists all currently mounted partitions.

For troubleshooting purposes, if there is a conflict between /proc/mounts and /etc/mtab information, the /proc/mount data is always more current and reliable than /etc/mtab.

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User Directories (/home/)

Every user on a Linux system has his own area in which to create files and remove them. This area is called the *home* directory of the user. When a user logs in, he is in his own home directory.

Individual configuration files can be found in the user's home directory. These configuration files are hidden files, because they are normally not displayed by the command ls. All these files have names that begin with a dot.

The following are the most important files in a user's home directory:

Table 2-5

File	Description
.profile	Private login script of the user
.bash_history	Configuration file for Bash
.bashrc	List of commands previously run in Bash

If there are no special settings, the home directories of all users are located beneath the directory /home/. The home directory of a user can also be addressed via the short cut “~”, so **~/.bashrc** refers to the file .bashrc in the user's home directory.

In many cases, the directory /home/ is located on a different partition or can even be located on a different computer (with central administration of home directories).

Filename Restrictions

A filename in Linux can be up to 255 characters long. It can contain any number of special characters (for example, “_” or “%”).

Certain special characters (the dollar sign “$”, the semicolon “;”, or the space, for example) have a specific meaning. If you want to use one of these characters without the associated special meaning, the character must be preceded by a “\” (backslash) so its special meaning is masked (switched off).

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Umlauts, letters with diacritical marks, or other country-specific characters can be used. Using them, however, can lead to problems when exchanging data with people in other countries using other settings if these characters are not present on their keyboards.

Linux differentiates between uppercase and lowercase letters. For example, **Invoice**, **invoice**, and **INVOICE** identify three different files.

Linux File System Permissions

When using OES Linux servers for network file storage and file system access, the configuration of local permissions often comes into play.

Before you configure and test file system access through the Novell OES Linux file access protocols provided by eDirectory, you must be familiar with the basics of how to manage traditional (POSIX) Linux file and directory permissions.

To set permissions for files and directories, you need to know the following:

- Permissions and Permission Values
- How to Set Permissions from the Command Line
- How to Set Permissions from a GUI Interface

Permissions and Permission Values

You can assign the following three permissions to a file or directory:

- **Read (r).** This permission allows the file to be read or the contents of a directory to be listed.
- **Write (w).** This permission allows a file to be modified. It allows files to be created or deleted within a directory.
- **Execute (x).** This permission allows a file to be executed. It allows access to a directory.

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You can use the command **ls -l** to display the contents of the current directory with the assigned permissions for each file or subdirectory.

For example, entering **ls -l** displays the following permissions for myfile.txt:

Figure 2-18

Owner Group Others

```
[root@RCE tmp]# ls -l
total 40
-rw-r--r--    1 root     root        12304 Dec 12 03:44 install.l
-rw-r--r--    1 root     root            0 Dec 12 03:17 install.l
-rwxr-xr--    1 root     root            6 Dec 12 14:55 myfile.tx
drwx------    2 root     root         4096 Dec 12 03:32 orbit-roo
-rw-rw-rw-    1 apache   apache          6 Dec 12 11:48 rcq-runne
-rw-------    1 apache   apache       6255 Dec 12 11:53 sess_51e5
ef964966f8775
-rw-------    1 root     root            0 Dec 12 11:48 session_m
-rw-------    1 root     root            0 Dec 12 11:48 session_m
drwxr-xr-x    8 201      201          4096 Dec 12 10:51 vmware-to
[root@RCE tmp]# _
```

You can also view permissions from a file manager or browser tool.

For example, you can use the Detailed List View in Konqueror to view permissions, owner, and group for each directory or file:

Figure 2-19

Name	Size	File Type	Modified	Permissions	Owner
bin	48 B	Folder	2004-07-09 08:22	rwxr-xr-x	geeko
Desktop	376 B	Folder	2004-07-24 08:31	rwx------	geeko
Documents	80 B	Folder	2004-07-09 08:22	rwxr-xr-x	geeko
public_html	80 B	Folder	2004-07-09 08:22	rwxr-xr-x	geeko
snapshot1.png	51.7 KB	PNG Image	2004-07-26 13:19	rw-r--r--	geeko
snapshot2.png	14.5 KB	PNG Image	2004-07-24 14:44	rw-r--r--	geeko

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How to Set Permissions from the Command Line

You can modify a file or directory's permissions and ownership from the command line by using the following:

- chmod
- chown and chgrp

chmod

You can use this command to add, remove, or assign permissions assigned to a file or directory. Both the owner of a file and root can use this command.

The following are examples of using the command chmod:

Table 2-6

chmod command	Description
chmod u+x	The owner is given permission to execute the file. The permissions r and w stay as they are.
chmod g=rw	All group members can read and write. If the members had the execute permission before, it is removed.
chmod u=rwx	The owner receives all permissions.
chmod u=rwx,g=rw,o=r	The owner has all permissions, the group has read and write permissions, and all others have read permission.
chmod +x	All users (owner, group, and others) receive executable permission, depending on umask.

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For example, entering the following chmod command lets all users in the group users write to the file hello.txt:

```
geeko@earth:~ > ls -al hello.txt
-rw-r--r-- 1 geeko users 0 2004-04-06 12:40 hello.txt
geeko@earth:~ > chmod g+w hello.txt
geeko@earth:~ > ls -al hello.txt
-rw-rw-r-- 1 geeko users 0 2004-04-06 12:40 hello.txt
```

With the option -R (recursive) and a specified directory, you can change the access permissions of all files and subdirectories under the directory.

Besides using the letters rwx to indicate permissions, you can also use groups of numbers.

Every file and directory in a Linux system has a numerical permission value assigned to it. This value has three digits.

The first digit represents the permissions assigned to the file or directory owner. The second digit represents the permissions assigned to the group associated with the file or directory. The third digit represents the permissions assigned to others.

Each digit is the sum of the following three values assigned to it:

- Read: **4**
- Write: **2**
- Execute: **1**

For example, suppose a file named myfile.txt has **754** permissions assigned to it.

This means the owner of the file has read, write, and execute permissions (**4+2+1**), the group associated with the file has read and execute permissions (**4+1**), and others have read permissions (**4**).

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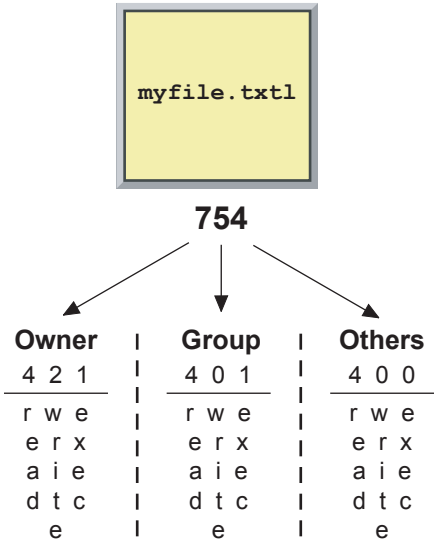
This is illustrated in the following:

Figure 2-20



The following are examples of using numerical values with chmod:

Table 2-7

chmod command	Description
chmod 754 hello.txt	The owner has all permissions, the group has read and execute permissions, and all others have the read permission.
chmod 777 hello.txt	All users (user, group, and others) receive all permissions.

chown and chgrp

These commands change the owner or group assigned to a file or directory.

As user root, you can use the command chown to change the user and group affiliation of a file using the following syntax:

chown ***new_user.new_group file***

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For example, in the following, root changes ownership of the file hello.txt from geeko to the user newbie:

```
earth:/tmp # ls -la hello.txt
-rw-r--r-- 1 geeko users 0 2004-04-06 12:43 hello.txt
earth:/tmp # chown newbie.users hello.txt
earth:/tmp # ls -la hello.txt
-rw-r--r-- 1 newbie users 0 2004-04-06 12:43 hello.txt
earth:/tmp #
```

To change only the owner (and not the group), use the following:

chown *new_user file*

To change only the group (and not the user), use the following:

chown *.new_group file*

For example, the following command is used to limit access to the file list.txt to members of the group advanced:

```
earth:/tmp # ls -la list.txt
-rw-r----- 1 geeko users 0 2004-04-06 12:43 list.txt
earth:/tmp # chown .advanced list.txt
earth:/tmp # ls -la list.txt
-rw-r----- 1 geeko advanced 0 2004-04-06 12:43 list.txt
earth:/tmp #
```

Although the group has changed, the owner permissions remain the same (the owner and root can still access the file).

As user root, you can also change the group affiliation of a file with the command chgrp using the following syntax:

chgrp *.new_group file*

A normal user can only use the command chown to change his or her file to a new group, as in the following:

chown *.new_group file*

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Of course, the user can also do the same with chgrp, as in the following:

chgrp ***new_group file***

Users can change the group affiliation of their files only if they are a member of the new group.

How to Set Permissions from a GUI Interface

Besides using commands (such as chmod or chown), you can modify a file or directory's permissions from a GUI interface (normally a file browser).

For example, you can use Konqueror in KDE to change permissions by doing the following:

1. Start **Konqueror**; then browse to the ***file*** or ***directory*** (do not open it).
2. Right-click the ***file*** or ***directory*** you want to modify; then select **Properties**.
3. Select the **Permissions** tab.

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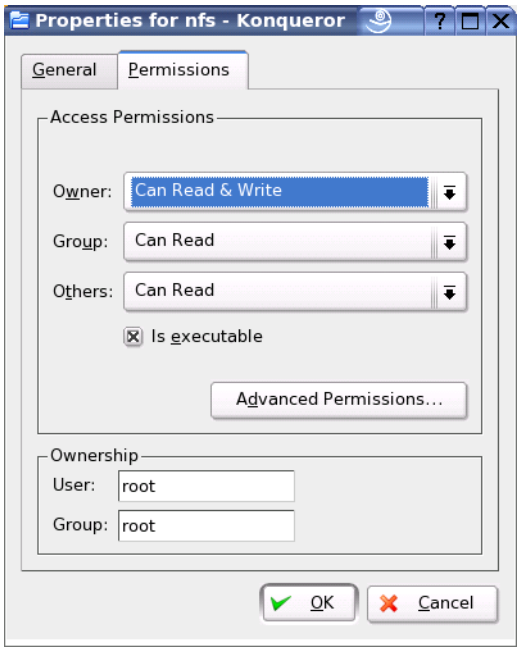
A dialog similar to the following appears:

Figure 2-21



From this dialog, you can change the Read (r) and Write (w) permissions for Owner, Group, and Others by selecting the appropriate option (**Can Read** or **Can Read & Write**) from the drop-down lists.

You can deny all permissions (equivalent to **0**) by selecting **Forbidden**.

You can also modify the user and group ownership of the file or directory by entering a user or group in the appropriate field.

4. Modify the permissions and ownership as desired.
5. (Optional) Modify individual permissions by doing the following:
   a. Select **Advanced Permissions**.

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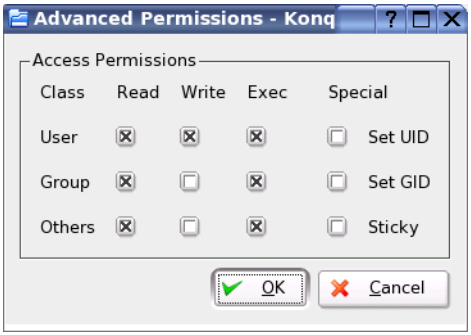
The following appears:

Figure 2-22



b. Select the ***permissions*** you want to set, and then finish by selecting **OK**.

6. When you finish configuring permissions for the file or directory, save the configuration by selecting **OK**.

For details on Linux POSIX permissions and NSS directory and file attributes, see "Access Control for NSS on Linux" on page 42 of the *Novell Open Enterprise Server File Systems Management Guide* (stor_filesys.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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Exercise 2-4 Manage Linux Files and Directories

Although you might already be familiar with managing NetWare and Windows file systems, if you are new to Linux, managing a Linux file system can be challenging,

You've already been introduced to some basic Linux file system management tasks in previous exercises in this section.

In this exercise, you extend that basic knowledge by doing the following:

- Mounting and unmounting file systems
- Setting Linux file and directory permissions

Exercise 2-4 Manage Linux Files and Directories is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 2-67.

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Summary

Objective	Summary
1. Manage an OES Linux Server from the KDE Desktop	In this objective you learned that one of the most used graphical desktop environments in Linux is KDE. This desktop environment is installed by default during the installation of OES Linux. To manage Novell OES servers effectively in this course (and in a production environment), you need to know the following: ■ What the root User Is ■ How to Log In ■ How to Log Out ■ How to Shut Down and Reboot the Linux System ■ How to Identify KDE Desktop Components ■ How to Use the Konqueror File Manager
2. Perform Administrative Tasks with YaST	In this objective you learned that YaST is a graphical utility that greatly simplifies the installation and configuration of components on SLES 9 servers. YaST stands for *Yet another Setup Tool*. To understand how YaST works with OES Linux, you need to know the following: ■ YaST and OES Linux Installation ■ YaST and OES Linux Configuration

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Objective	Summary
2. Perform Administrative Tasks with YaST (*continued*)	■ Adding Novell OES Services to OES Linux ■ The Role of SuSEconfig
3. Manage an OES Server from a Bash Shell	In this objective you learned that OES Linux allows you to manage a server from a command prompt. You also learned how you can transition to OES Linux with the the skills you already have by practicing with the following: ■ Virtual Consoles on OES Linux ■ Bash Shell on OES Servers ■ Bash Shell and OES NetWare ■ Common Bash File System Commands ■ Bash Command Web References ■ NetWare Commands and Linux Equivalents

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Objective	Summary
4. Manage the Linux File System	In this objective you learned that the Linux file system (and, in general, any UNIX system) is considerably different from that of other operating systems. To successfully manage an OES Linux system, you need to understand the basics of the following topics: ■ Linux File System Types ■ The Hierarchical Structure of the File System ■ FHS (Filesystem Hierarchy Standard) ■ Root Directory (/) ■ Storage Devices ■ File System Mount Points ■ User Directories (/home/) ■ Filename Restrictions

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SECTION 3 Manage Novell OES Servers

In this section, you learn how to manage Novell OES NetWare and OES Linux servers by using OpenSSH, Novell Remote Manager, iMonitor, and iManager.

Objectives

1. Manage OES Servers Remotely with OpenSSH
2. Manage OES Servers with Novell Remote Manager (NRM)
3. Monitor eDirectory Trees on OES with Novell iMonitor
4. Manage Novell OES Servers with Novell iManager

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Introduction

In this section, you learn how to use some fundamental tools available in Novell Open Enterprise Services (OES) to manage Novell OES servers and services.

Because these tools sometimes provide the same type of feature (such as hard drive partition information), it can be difficult to know when to use each tool.

This is skill learned with experience, and often depends on which tool you are currently using. It also includes personal preferences.

As you review and use tools such as iMonitor, Novell Remote Manager, and Novell iManager in this section, you might find it helpful to refer to the following table as an overview of the purpose of each tool:

Table 3-1

File	Description
Bash	A command-line shell for performing file system and system tasks such as the following: ■ Create, rename, move, and delete files and directories. ■ View the permissions and content of files and directories. ■ Monitor, start, and stop processes and daemons. ■ Remotely connect to other servers through utilities and protocols such as FTP and SSH.
Novell Remote Manager (NRM)	A browser-based utility that you can use to manage one or more OES servers from a remote location. WIth NRM, you can perform tasks such as the following: ■ Monitor and manage your server's health. ■ View information about all hardware adapters, hardware resources, and processor data.

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(continued) **Table 3-1**

File	Description
Novell Remote Manager (NRM) (*continued*)	■ Monitor system disk space and memory resources. ■ Access server and configuration logs. ■ Manage disk partitions. ■ Access files on volumes and DOS partitions. ■ Manage server connections. ■ Set schedules for running console commands. ■ Shut down, restart, or reset a server. ■ Troubleshoot server problems.
iMonitor	Novell iMonitor provides cross-platform monitoring and diagnostic capability to all servers in your eDirectory tree through a web browser. While Novell Remote Manager focuses on server management, iMonitor focuses on eDirectory by letting you ■ Look at the eDirectory environment in depth on a partition, replica, or server basis. ■ Examine which eDirectory tasks are taking place, when they are happening, what their results are, and how long they are taking. The following are some of the features provided in iMonitor: ■ eDirectory health summary ■ eDirectory health checks ■ Hyperlinked DS Trace ■ Agent configuration ■ Agent activity and verb statistics ■ Reports ■ Agent information ■ Error information ■ Object/schema browser

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(continued) **Table 3-1**

File	Description
Novell iManager	Novell iManager is a web-based administration console that provides secure, customized access to utilities that provide ■ A single point of administration for Novell eDirectory objects, schema, partitions and replicas ■ Management of OES services through iManager plug-ins ■ Role-Based Services (RBS) for delegated administration ■ Health Monitoring Services (using Web-Based Enterprise Management) for monitoring the health of Linux or NetWare operating systems

Although there is some overlap in functionality between tools, you primarily use NRM to manage servers, iMonitor to check your servers from an eDirectory perspective, and iManager to configure and manage Novell OES services.

For a complete and detailed listing of all available management tools, see "Overview of Management Tools and Interfaces" on page 91 of the Novell *Novell OES SP2 Planning and Implementation Guide* (implgde.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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Objective 1 Manage OES Servers Remotely with OpenSSH

Many users of telnet, rlogin, ftp, and other such programs might not realize that their passwords and data are transmitted across the Internet unencrypted.

OpenSSH is an open source SSH (Secure SHell) package that encrypts all traffic (including passwords) to effectively eliminate eavesdropping, connection hijacking, and other network-level attacks.

Additionally, OpenSSH provides a variety of secure tunneling capabilities.

Novell OES provides the package OpenSSH on both OES Linux and OES NetWare. To effectively use OpenSSH for remotely performing basic administrative tasks on OES servers, you need to know the following:

- Benefits of OpenSSH
- OpenSSH and OES Linux
- OpenSSH and OES NetWare
- How to Use SSH Commands

Benefits of OpenSSH

The following is a brief list of some of the benefits of integrating OpenSSH with Novell OES:

- You users can securely access and copy files in their home directories on OES Linux or OES NetWare servers from remote locations without using a browser or proprietary client.
- You can gain remote access to any server in your network and copy files and directories to and from other servers in their networks using ssh utilities.

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- You can put ssh utility commands in script files to automate many routine tasks.
- Because the SSH client protocols have been ported to NetWare, you can use the SSH commands from a remote client or from a remote server on the network running NetWare 6.5 to copy files from one server to another server.
- SSH protocols let you connect to the server and automatically send a command, so the server will run that command and then disconnect. This means you can use automated processes.
- SSH protocols provide security of your data transmissions and communications across the Internet whether you are outside or inside a firewall. You can be confident that hackers will not be able to access your data.

OpenSSH and OES Linux

The package OpenSSH is installed by default on OES Linux (SLES 9). The programs ssh, scp, and sftp are then available as alternatives to telnet, rlogin, rsh, rcp, and ftp.

The following OpenSSH information is specific to OES Linux:

- How to Configure the SSH Server
- SSH Server Commands
- How to Configure the SSH Client

For complete information on OpenSSH and OES Linux, refer to “SSH — Secure Shell, the Safe Alternative” on page 444 of the *SUSE LINUX Enterprise Server 9 Administration Guide* (sles_admin.pdf).

You can access this guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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How to Configure the SSH Server

The configuration file for the OpenSSH server is /etc/ssh/sshd_config. Some of the more commonly used options in the configuration file include the following:

Table 3-2

Option	Description
AllowUsers	Allows an SSH login for selected users
DenyUsers	Denies an SSH login for selected users
Protocol	Specifies the protocol versions supported. (Default: 2,1)

For additional information on SSH server configuration options, enter **man sshd**.

SSH Server Commands

The following programs and commands are important to running an SSH server on OES Linux:

Table 3-3

Program/ Command	Description
/usr/sbin/sshd	This is the SSH daemon (controlled via the script /etc/init.d/sshd). In a standard OES Linux installation, the SSH daemon is started automatically in runlevels 3 and 5.
ssh-keyscan	This command collects public host keys from SSH servers. It finds the public host key of an SSH server and displays this on the standard output. This output can then be compared with the key in the file /etc/ssh/ssh_known_hosts and be included in the file.

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In the following ssh-keyscan example, the host key is read from the computer DA10:

```
geeko@DA50:~> ssh-keyscan DA10
# DA10 SSH-1.99-OpenSSH_3.8p1
DA10 1024 35 147116390451437464467351275310861709847606158
603563071800818865787706191767856017132785636399973349166 0
638798596783694010266253476047943925066209502287165836863 3
620359489209689637492730587921018893416433694770658474306 6
290431167188190984198742641974982665121723726610710391613 1
904386054478419588421497406201 27
```

How to Configure the SSH Client

You configure the SSH client by editing the file /etc/ssh/ssh_config. Users can edit their individual settings in the file ~/.ssh/config.

If you want to ensure (in general) that only previously entered servers are accepted, then you need to set the option StrictHostKeyChecking in the client configuration file (~/.ssh/config) to **Yes** (on).

This prevents the client from simply entering new keys from unknown servers without checking. This is only entered on the first connection.

In SSH version 1.2.20 and later, three values are allowed for StrictHostKeyChecking: Yes, No, and Ask. The default setting is ask, which means that before a new key is entered, the user is asked for permission.

For additional information on SSH server configuration options, enter **man ssh**.

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OpenSSH and OES NetWare

OpenSSH on OES NetWare uses encryption provided by Novell International Cryptographic Infrastructure (NICI) technology, rather than SSL to implement 128-bit (and stronger) encryption and contains fewer software import liabilities.

In NetWare 6.5, Novell has integrated OpenSSH version 3.7p1. Through this secure shell, users who are Admin equivalent can gain remote access to any server in the network for copying files and directories with SSH utilities.

When using OpenSSH on OES NetWare, you also need to know the following:

- OpenSSH Components on OES NetWare
- OpenSSH Utilities on OES NetWare
- Unique OES NetWare OpenSSH Features

For complete information on OpenSSH and OES NetWare, refer to the *Novell OES OpenSSH Administration Guide for NetWare* (openssh.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

OpenSSH Components on OES NetWare

After you set up OpenSSH on your OES NetWare server, it should contain the following components in the indicated locations:

- sshd.nlm (sys:\system)
- sshd_config (sys:\etc\ssh)
- ssh_host_key (sys:\etc\ssh)
- ssh_host_rsa_key (sys:\etc\ssh)
- ssh_host_dsa_key (sys:\etc\ssh)
- sshjni.nlm (sys:\system)

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- sshlogd.nlm (sys:\system)

OpenSSH Utilities on OES NetWare

The OpenSSH suite integrated with NetWare 6.5 includes the following:

- The ssh program that replaces rlogin and telnet
- scp (replaces rcp)
- sftp (an alternative to ftp)
- sshd (server side of the package)
- Other basic utilities like ssh-keygen or sftp-server

OpenSSH supports SSH protocol versions 1.3, 1.5, and 2.0.

Unique OES NetWare OpenSSH Features

The following tools and features are unique to OES NetWare OpenSSH implementation:

- **OpenSSH Manager.** Any user that belongs to the sshadmn-Administrators group is granted access to the OpenSSH Manager to modify the configuration of OpenSSH servers.

  The OpenSSH Manager can be accessed via web browser ssl connection to port 2200. This tool lets you perform tasks such as viewing ssh connections, changing the sshd_config file more easily, and setting log preferences.

- **SSH log daemon.** This agent generates the log files that contain all the logs and errors sent from all ssh-type NLM™ programs such as sshd, ssh, sftp, or scp.

- **Authentication.** OpenSSH uses password authentication through LDAP. This authentication gathers all the user's credentials from Novell eDirectory.

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After users have authenticated, the current working directory is their home directory if configured in eDirectory; otherwise, they will be at the root of the server volumes of the server they connected to.

Users can navigate as they would with ftp to any directory on that server for which they have been assigned rights in eDirectory.

The ssh localhost command does not work on an OES NetWare server; however, the scp localhost and sftp localhost commands do work.

How to Use SSH Commands

You can use an SSH client on OES NetWare or OES Linux to access the server and perform administrative or file tasks.

OES Linux includes an SSH client with the X Server desktop environment. Before running the client, make sure you change the Window Row setting from the default to a value greater than 25.

The following introduces you to some of the basic commands and options for running SSH utilities from an SSH client:

- SSH Commands
- SSH Command Options
- SSH Command Examples

For complete information and listing of all SSH commands, refer to the *SUSE LINUX Enterprise Server 9 Administration Guide* (sles_admin.pdf) and the *Novell OES OpenSSH Administration Guide for NetWare* (openssh.pdf).

You can access these guides from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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SSH Commands

After downloading an SSH-compliant client to your workstation, you can use the following commands to accomplish basic tasks on an OES server running an OpenSSH server:

Table 3-4

Command	Description
ssh	Connect and log in to the specified server (hostname). You must provide your identity (such as **ssh admin@10.0.0.1**) to the remote machine.
sshd	Control how the daemon logs you in.
sftp	Perform secure file transfers with FTP-like command that works over SSH1 and SSH2 protocols.
scp	Copy files between hosts on a network. It uses SSH1 for data transfer, and uses the same authentication and provides the same security as SSH1. Scp asks for passwords or passphrases if they are needed for authentication.

SSH Command Options

From an SSH client, you can use the following basic options with the ssh command:

Table 3-5

Option	Description
-b *bind_address*	Specify the local IP address to transmit from machines with multiple addresses or aliased addresses.
-C	Enable compression.
-D *port*	Enable dynamic application-level port forwarding.
-f	Fork into background after authentication.

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(continued) **Table 3-5**

Option	Description
-g	Allow remote hosts to connect to forwarded ports.
-l *username*	Log in using the specified user name.
-L *listen-port:host:port*	Forward local port to remote address. This causes ssh to listen for connections on a port and forward them to the other side by connecting to host:port.
-p port	Connect to the specified port. The server must be on the same port.
-q	Do not display any warning messages.
-R listenport:	Forward remote port to local address.
host:port	Causes ssh to listen for connections on a port and forward them to the other side by connecting to host:port.
-x	Disable X11 connection forwarding (default).
-X	Enable X11 connection forwarding.

SSH Command Examples

The following are some examples of using the SSH client commands from an OES Linux command prompt:

- **root@DA2:~ > ssh da4.da.com**

  In this example, the user root logs in to the computer **da4.da.com**.

- **root@DA2:~ > ssh -l admin da4.da.com**

  or

  root@DA2:~ > ssh admin@da4.da.com

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In these examples, the user root on the computer DA4 logs in as the user admin on the computer da4.da.com.

- **root5@DA2:~ > scp /etc/hosts da4.da.com:/tmp**

  In this example, the user root copies the local file /etc/hosts to the sys:/tmp directory on the computer da4.da.com.

- **root@DA2:~ > ssh -X da4.da.com**

  In this example, the user root logs in to the host da4 from da2 using SSH. The connection is established with a graphical X11 tunnel, allowing X11 applications started on da4 to be displayed on da2.

- **root@DA2:~ > ssh -L 4242:da2.da.com:110 admin@da4.da.com**

  In this example, the user root forwards the connection coming in on port 4242 of the local host da2 to port 110 (POP3) of the remote host da4 via an SSH tunnel (port forwarding).

  By using port forwarding through an SSH tunnel, you can set up an additional secure channel for connections between the local host and a remote host.

Privileged ports (0–1024) can only be forwarded by root on Linux.

In addition, you can forward port queries addressed to a port of a remote host to the port of the local host (reverse port forwarding) by entering a command similar to the following:

- **root@DA2:~ > ssh -R 4242:da2.da.com:110 admin@da4.da.com**

  In this example, queries coming in on port 4242 of the remote host da4 are reverse-tunneled via SSH to port 110 of the local host da2.

  If the host you want to forward to cannot be reached directly through SSH (for example, because it is located behind a firewall), you can establish a tunnel to another host running SSH, as in the following:

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- **root@DA2:~ > ssh -L 4242:da4.da.com:110 admin@da1.da.com**

  In this example, the user root forwards incoming connections on port 4242 of the local host da2 to the remote host da1 by way of an SSH tunnel.

  This host then forwards the packets to port 110 (POP3) of the host da4 by using an unencrypted connection.

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Exercise 3-1 Manage OES Servers Remotely with OpenSSH

In this exercise, you use OpenSSH to manage the DA1 Linux and DA2 NetWare servers from a command prompt.

Exercise 3-1 Manage OES Servers Remotely with OpenSSH is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 3-2.

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Objective 2 Manage OES Servers with Novell Remote Manager (NRM)

Novell Remote Manager (NRM) is a browser-based utility that you can use to manage one or more OES NetWare or OES Linux servers from a remote location.

In this objective, you learn the following about NRM:

- NRM in a Mixed Novell OES Server Environment
- How to Get Started with NRM on OES NetWare
- How to Get Started with NRM on OES Linux
- How to Configure Groups and Group Operations

For complete information on NRM, refer to the *Novell Remote Manager Administration Guide for Linux* (remotemgr_lx.pdf) and the *Novell Remote Manager for NetWare Administration Guide* (remotemgr.pdf).

You can access these guides from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

NRM in a Mixed Novell OES Server Environment

To use NRM effectively in a mixed OES server environment, you need to know the following:

- NRM Administrative Task Comparison
- Coexistence and Compatibility Issues

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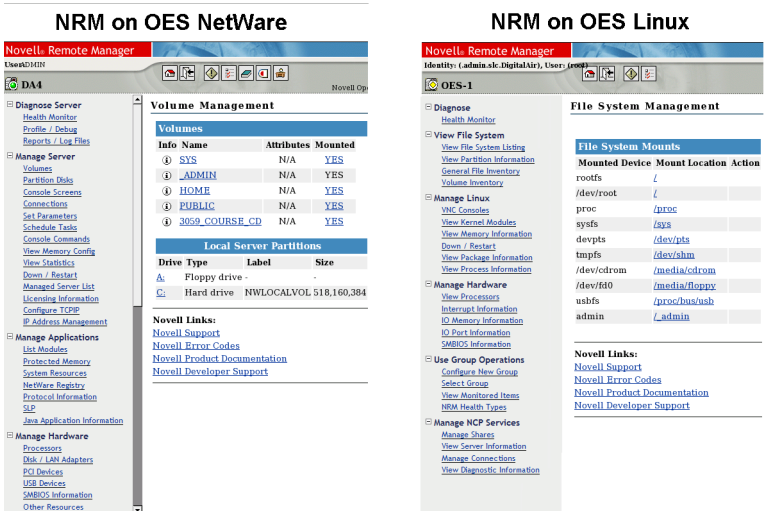
NRM Administrative Task Comparison

When you first open NRM on OES NetWare and NRM on OES Linux, you will notice some significant differences:

Figure 3-1



While you can perform many of the same administrative tasks with NRM on both OES NetWare and OES Linux servers, NRM on OES Linux has some limitations in functionality (when compared to NRM on OES NetWare).

However, there are some tasks (such as monitoring server processes) critical to managing a Linux server that are included exclusively in NRM on OES Linux.

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The following compares the availability of major NRM features on OES NetWare and OES Linux:

Table 3-6

Task	OES Platform
Monitor and manage your server's health:	
■ Monitor the health status of one or more servers.	■ NetWare/Linux
■ Build a group of servers that you can perform group operations on.	■ NetWare/Linux
■ Access Novell eDirectory health and troubleshooting tools.	■ NetWare
■ Access server and configuration logs.	■ NetWare/Linux
Configure your server:	
■ Manage disk partitions.	■ NetWare
■ Access server console screens.	■ NetWare/Linux
■ View information about all hardware adapters, hardware resources, and processor data.	■ NetWare/Linux
■ Upload and replace NLM programs, LAN drivers, or disk drivers.	■ NetWare
■ Upload, access, and replace files	■ NetWare/Linux
■ Monitor system disk space and memory resources.	■ NetWare/Linux (memory only)
■ Access files on volumes and DOS partitions.	■ NetWare
■ Manage server connections.	■ NetWare
■ Configure Set parameters.	■ NetWare
■ Set schedules for running console commands.	■ NetWare
■ Shut down, restart, or reset a server.	■ NetWare/Linux

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(continued) **Table 3-6**

Task	OES Platform
Troubleshoot server problems:	
■ Find CPU hogs.	■ NetWare
■ Run and view inventory reports for one or more servers.	■ NetWare
■ Find high memory users.	■ NetWare/Linux
■ Trace abend sources.	■ NetWare
■ Locate server process hogs.	■ NetWare
■ Find disk space hogs.	■ NetWare
■ See who is using an open file.	■ NetWare
■ Monitor server processes.	■ Linux

When you have other products and utilities installed and loaded on the server, you can perform additional tasks such as the following from NRM:

- Manage and monitor Novell Cluster Services™
- Monitor IPP print service health
- Manage IP addresses
- Monitor Novell licenses (NetWare)

Coexistence and Compatibility Issues

The following provides information about the compatibility and coexistence of NRM for Linux or NetWare with existing networks containing NetWare or Linux platforms:

- All NRM management features are available for the NetWare operating system with the exception of the Group Monitoring Operations.

  When you create a group, you can get server health status from a NetWare server running NetWare 6.0 or later or from a Linux server running Novell OES.

- You can access NRM on Linux only on servers with OES services installed.

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- The version of NRM included in OES can run only on NetWare 6.5 SP3 servers.
- Linux servers not running the owcimomd module or servers not running NetWare 6 or 6.5 can report only an Up/Down status.
- The following table summarizes the compatibility of NRM for NetWare with various operating systems:

Table 3-7

Monitoring Type	Operating System	Compatible Versions
Ping	Any	NA
NRM	NetWare	■ OES on NetWare ■ NetWare 6.5 SP3
NRM	Linux	■ OES on SUSE® LINUX Can get full health status ■ SUSE LINUX Enterprise Server 9 SP1 Can only get an Up/Down status

How to Get Started with NRM on OES NetWare

NRM (portal.nlm) provides all the functionality of Monitor on NetWare, along with some functionality of other utilities available at the server console; however, NRM makes this functionality available from a Web browser.

You need to be familiar with the following to use NRM on OES NetWare:

- NRM Advantages
- Administrative Tasks on OES NetWare Servers
- What’s New for NRM on NetWare 6.5 in OES SP1 and SP2
- System Requirements
- How to Log In to NRM for NetWare
- How to Log Out of NRM for NetWare

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- Restarting NRM or the HTTP Interface
- Accessing and Managing Other NetWare Servers
- NRM Limitations on OES NetWare

For complete information on NRM on OES NetWare, refer to the *Novell Remote Manager for NetWare Administration Guide* (remotemgr.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

NRM Advantages

Using NRM on OES NetWare rather than Monitor or RConsole for server management provides the following advantages:

- It accesses information much more quickly than other remote management tools.
- It is installed by default on all NetWare servers and requires no special configuration for most operations.
- It does not require a special client.
- It provides a graphical interface that makes interpreting diagnostic information much more comprehensible and easier to manage.
- It provides added functionality that is not available in the other management utilities.

Administrative Tasks on OES NetWare Servers

While using NRM in OES NetWare, you can perform the following major tasks:

- Monitor and manage your server's health:
  - Monitor the health status of one or more servers.

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  - Build a group of servers that you can perform group operations on.
  - Access Novell eDirectory health and troubleshooting tools.
  - Access server and configuration logs.
- Configure your server:
  - Manage disk partitions.
  - Access any server console screen.
  - View information about all hardware adapters, hardware resources, and processor data.
  - Upload and replace NLMTM programs, LAN drivers, or disk drivers.
  - Monitor system disk space and memory resources.
  - Access files on volumes and DOS partitions.
  - Manage server connections.
  - Configure Set parameters.
  - Set schedules for running console commands.
  - Shut down, restart, or reset a server.
- Troubleshoot server problems:
  - Find CPU hogs.
  - Run and view inventory reports for one or more servers.
  - Find high memory users.
  - Trace abend sources.
  - Find local server process hogs.
  - Find disk space hogs.
  - Determine who is using an open file.

When you have other products and utilities installed and loaded on the server, you can perform additional tasks such as the following:

- Manage and monitor Novell Cluster Services™.
- Monitor IPP print service health.
- Manage IP addresses.

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- Monitor Novell licenses.

What's New for NRM on NetWare 6.5 in OES SP1 and SP2

The following lists the features that were added or changed in NRM on NetWare 6.5 in OES SP1 and SP2:

Table 3-8

Feature	Functionality	Support Pack
Access	The left navigation frame includes collapsible categories that are remembered the next time you log in. This lets you display the Novell Remote Manager features that you use most often and hide the ones that you don't.	SP1
Configure	Control access to Novell Remote Manager.	SP1

Diagnose Server	A Faulted Address Space Count health item has been added to the Health Monitor page.
	With this health item you can
	■ View health status for faulted address spaces.
	■ Access the Faulted Address Space Count page where you can
	  ■ View fault information about all address spaces loaded on the server
	  ■ Clear the fault count for a specific address space
	  ■ Access the Address Space Information page for a specific address space
		SP2

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(continued) **Table 3-8**

Feature	Functionality	Support Pack
Diagnose Server	You can configure email notifications for health alerts to contain the specific health item in the message heading rather than the default message heading of Server Health Warning.	SP2
Diagnose Server	The server health item for Available Memory is configured by default with threshold values calculated as a percentage of the total server memory. Starting with OES SP2, adjustments have been made to the server's memory handling that allow for lower values for these thresholds, so the defaults for Suspect and Critical levels have been changed.	SP2
Manage Applications, List Modules	On the List Modules page, you can now view the Load Date and Time information for each module.	SP1
Manage Server, View Memory Config	On the View Memory Config page the following changes were made: ■ Available Cache Memory was changed to Available Memory. ■ Available Kernel Space was changed to Free Kernel Space.	SP1
Manage Server, Volumes	Purge specific directories with their files on NSS volumes.	SP1
Manage Server, Volumes	On the File Information page, the Record Lock Information for NSS files now displays a status of Not Available rather than None.	SP1

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(continued) **Table 3-8**

Feature	Functionality	Support Pack
Manage Server, Console Screens	When a user accesses the console screens through the Console Screens link, a message is sent to the Logger screen indicating the session is granted and indicates the username, IP address, and time that the connection is made.	SP1
Manage Server, Set Parameters	If a Set parameter has been changed using Novell Remote Manager, you can set it back to its default value.	SP1
Manage Server, Volumes (Home)	View a list of all open files for each volume and close multiple connections to a specific file.	SP1
Manage Server, Volumes (Home)	Unavailable partitions are now displayed on the Volume Management (Home) page.	SP1

For additional details on new features added to NRM before OES SP1, see "What's New" on page 17 of the *Novell Remote Manager for NetWare Administration Guide* (remotemgr.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

System Requirements

The following are system requirements for accessing NRM for NetWare:

- NetWare 5.1 or later

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- Mozilla Firefox 1.0, Microsoft Internet Explorer 6 or later, Mozilla 1.7 (SLES 9 SP1 and Linux Professional 9.2), KDE 3.2 Konqueror (limited functionality), NetWare Server browser, or Safari 1.2 (limited functionality; font text set at medium or smaller)
- The portal and httpstk NLM programs loaded on the server.

  These files are loaded by default in the autoexec.ncf file during all NetWare installations.

How to Log In to NRM for NetWare

You can log in to NRM for NetWare by doing the following:

1. Open a supported web browser from your workstation or another server.
2. Point the browser to the URL of the server you want to manage by entering the following in the address (URL) field:

   http://*server_IP_address*:8008

   For example, if the server IP address is 10.200.200.4, you would enter the following:

   http://10.200.200.4:8008

The default alternate port number is 8008. If you have changed this value on the Configuration page in NRM, make sure you specify the same value for the port number.

If you have Domain Name Services (DNS) installed on your network for server name-to-IP address resolution, you can also enter the server's DNS name instead of the IP address.

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If you want to access NRM from the outside of a firewall and the server's private address is unreachable except through Network Address Translation (NAT) or by proxy, make sure that DNS is configured on your server, and then change the load line for loading the httpstk.nlm to the following in the autoexec.ncf file:

load httpstk.nlm /hostids:1 /SSL /keyfile:"SSL CertificateIP"

3. Accept the SSL certificate.

You must have SSL 2.0 and SSL 3.0 (where available) enabled in your browser; otherwise, the browser displays an error indicating that the page cannot be displayed.

4. When the login dialog box appears, enter the ***username*** and ***password***.

   To have access to all pages necessary to manage your server remotely, you need to log in as a user with the Supervisor right to the Server object. This is normally user Admin or a user with rights equivalent to user Admin.

If the Set Bindery Context = line has been removed from the autoexec.ncf file or the default eDirectory context has not been changed, enter the full context of the user you are logging in as.

If you log in as a user without the Supervisor right to the Server object, you will see only pages that display the volumes, directories, and files that you have access to.

You can view files (where you have read access) and upload files into directories where you have write access.

However, you cannot see or do any of the management functions with the exception of being able to set a Simple Password for NFAP on the NFAP Simple Password Management page (if this is set up on the server).

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You can access this page by selecting the **User Tools** icon in the header frame and then clicking the **NFAP Security** link in the navigation frame.

How to Log Out of NRM for NetWare

To log out of NRM, select the Exit icon at the top of the NRM page, and then close all your browser windows at the workstation you logged in from.

Your NRM session remains open until you close all your browser windows (including tabbed windows).

Restarting NRM or the HTTP Interface

After you have made changes to the OES NetWare server that require portal.nlm or httpstk.nlm to be restarted, or after you have loaded a newer version of these NLM programs on the server, make sure you select the applicable Restart button to unload and reload the module.

A message appears asking if you are sure you want to restart the module (which temporarily disables the utility). If you choose to restart, a page appears stating that the reset is taking place.

When the reset is complete, the page refreshes to the Configuration page with the changed settings—if you haven't changed the port settings. If you have changed the port settings, remember to use the new numbers when accessing NRM.

We recommend that you unload and reload portal.nlm and httpstk.nlm on the Configuration Options page of NRM (instead of the system console).

The functionality provided from the Configuration Options page keeps track of the plug-in modules that have dependencies with these NLM programs and unloads and reloads all the required modules.

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If you unload portal.nlm or httpstk.nlm at the server console, you might run into problems with module dependencies (such as timesync, libc, tcpstats, and nwusage) that have been established, and the NLM might not unload.

If you successfully unload the modules, the dependent plug-in modules must be loaded manually after portal.nlm.

Accessing and Managing Other NetWare Servers

To access other NetWare servers in your eDirectory tree that have NRM loaded, select **Manage Server > Managed Server List**. A list of servers is provided via SLP (Service Location Protocol).

When the list of NetWare servers is first displayed, it might include servers outside the current tree, as reported by SLP.

The question mark icon next to the server name indicates that the portal.nlm is checking its availability. The question mark icon changes to a server icon if it is in the current tree or is removed if the server is not in the current tree.

Filtering the server list might take several minutes if the list is long.

To refresh the list, reload the page by selecting the Manage Server List link again, then refresh the list using normal browser functionality.

NRM Limitations on OES NetWare

The following issues are known limitations of NRM that might not be resolved in this release:

- **Characters not displaying.** In this release, NRM for NetWare is dependent on the code page (language) of the server being monitored.

  Any character in a file or folder name that is not part of the server's local or native character set cannot be displayed.

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For example, if the names contain characters outside the server's code page/character set, you might see blank entries for the items in a file listing.

Even though files and folders whose names contain these characters can be created or migrated to the server, they are not usable through the Novell Remote Manager utility on NetWare until this limitation is addressed (in a future release).

- **Use group operations.** Some of the Server Group reports and operations that are currently documented as available in the *Novell Remote Manager for NetWare Administration Guide for OES* are not available when you upgrade to NetWare 6.5 SP3 or OES SP1.

  As the Server Group functionality of NRM continues to develop across both NetWare and Linux platforms, the Group Reporting and Group Operations functionality will be restored as it becomes available in a future support pack release. Fixes might also be available as downloadable modules from the Novell Support Web site before the next release.

  The documentation has not been updated to remove the descriptions and instructions for these features because they will be restored.

- **Novell iManager link from NRM.** When you select the button in the header frame to access iManager, iManager takes over the current browser window rather than opening a new window on top of the NRM window.

  Use the browser's back button to return to NRM, or open another browser window for NRM. The same functionality applies to the links for NDS iMonitor and DS Trace under the Manage eDirectory heading.

- **Available server memory health status.** The server health item for Available Memory is configured by default with threshold values calculated as a percentage of the total server memory.

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Starting with OES SP2, adjustments have been made to the server's memory handling that allow for lower values for these thresholds, so the defaults for Suspect and Critical levels have been changed.

These changes to the default threshold values are configured on a new server installation with OES SP2 (NW6.5 SP5), but the defaults are not automatically changed on a server that you upgrade to the latest Support Pack to avoid overwriting any custom values you may have already set for these thresholds.

If you see the Available Memory server health item showing a status of Suspect (yellow) or Critical (red) after applying the Support Pack (which might or might not occur, depending on the server memory and existing settings), adjust the threshold values to the new defaults for Available Memory.

To adjust the threshold values to the new defaults for the Available Memory health item, do the following:

1. From Novell Remote Manager, select **Diagnose Server > Health Monitor**.
2. Select **Threshold Configuration > Available Memory > Restore Default Values > OK**.

How to Get Started with NRM on OES Linux

NRM for Linux is a browser-based utility that you can use to manage one or more OES Linux or OES NetWare servers from a remote location.

You can use the OES Linux version of NRM to monitor your server’s health, change the configuration of your server, or perform diagnostic and debugging tasks.

You need to be familiar with the following before you start using NRM on OES Linux:

- Administrative Tasks on OES Linux Servers
- System Requirements

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- How to Access NRM for OES Linux
- How to Start or Stop Httpstkd
- How to View the HTTP Logs
- How to Manage an OES Linux Server from NRM

For complete information on NRM for Linux, refer to the *Novell Remote Manager Administration Guide for Linux* (remotemgr_lx.pdf).

You can access this guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

Administrative Tasks on OES Linux Servers

While using Novell Remote Manager on OES Linux, you can perform the following major tasks:

- Monitor and manage your server's health:
  - Monitor the health status of one or more servers.
  - Build a group of servers and items to be monitored together.
  - Access server and configuration logs.
- Configure your server:
  - View information about all hardware adapters, hardware resources, and processor data.
  - Upload and replace files.
  - Monitor memory resources.
  - Access files.
  - Shut down or reset a server.
- Troubleshoot server problems:
  - Find high memory users.
  - Monitor server processes.

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What's New for NRM on OES Linux in OES SP1 and SP2

The following lists the features that were updated in NRM on OES Linux in OES SP1 and SP2:

Table 3-9

Feature	Functionality	Support Pack
Access	Network services now has a selection for installing the Novell Remote Manager services. This lets you install Novell Remote Manager after the server installation and performs the proper configuration steps that weren't performed if you installed the packages separately.	SP1
Configure	Added configuration options for controlling which users can log in to Novell Remote Manager and specifying which languages the browser supports for Novell Remote Manager.	SP1
Diagnose, Health Monitor	CPU usage process information is now reporting the correct information.	SP1
Manage Linux VNC Consoles	If VNC services are configured on the server, you can access the VNC console screens by selecting the **VNC Consoles** link under the Manage Linux heading in the navigation frame; then select the **1024 X 728** button on the VNC Console Screens page.	SP1

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(continued) **Table 3-9**

Feature	Functionality	Support Pack
Use Group Operation	If you want to scan the network for specific services, access the Network Discovery page and specify the host and ports that should be scanned for. After discovering the items on the network, you can click the item and add it to the current group for future monitoring. Using this feature can help you to quickly gather the information you need to create monitoring groups.	SP2
View File System	The General File Inventory link in this section provides a page where you can get an inventory of all the files from the root directory or browse to a specific subdirectory and generate a file inventory of all the files in the selected subdirectory. This same functionality is available by selecting the Inventory link when browsing the file system from the View File System link. The Volume Inventory link in this section provides a list of all NCP mounted volumes. When you click the volume name link from this page, an inventory report of all the files from the root of that volume is generated. From these generated reports, you can also perform actions on the files or directories such as moving, copying, deleting, and renaming.	SP2

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(continued) **Table 3-9**

Feature	Functionality	Support Pack
View File System (Home)	The left navigation frame includes collapsible categories that are remembered the next time you log in. This lets you display the Novell Remote Manager features that you use most often and hide the ones that you don't.	SP1
View File System (Home)	On the home page, you can view the percent of free space available on each mounted physical device or external file system that has actual disk space. Available disk space on virtual file systems is not shown. You can also view the details of the file system on the Information Page for each mounted system on the device. The Unmount button was moved to this page.	SP2

For additional details on new features added to NRM before OES SP1, see "What's New" on page 15 of the *Novell Remote Manager Administration Guide for Linux* (remotemgr_lx.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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System Requirements

The following are system requirements for running NRM for OES Linux:

- Mozilla Firefox 1.0, Microsoft Internet Explorer 6 or later, Mozilla 1.7 (SLES 9 SP1 and Linux Professional 9.2), KDE 3.2 Konqueror (limited functionality), or Safari 1.2 (limited functionality)
- The httpstkd module loaded and running on the server.

  This module is installed and configured with a default configuration when you install any component of the default Novell OES software selection on Linux or any of the following software selections:

  - Novell iFolder®
  - Novell iPrint
  - Novell Quickfinder™
  - Novell Virtual Office

How to Access NRM for OES Linux

You can log in to NRM for OES Linux by doing the following:

1. Open a supported web browser from your workstation or desktop.
2. Point the browser to the URL of the server you want to manage by entering the following in the address (URL) field:

   http://*server_IP_address*:8008

   For example, if the server IP address is 10.0.0.4, you would enter the following:

   http://10.200.200.4:8008

   If you have Domain Name Services (DNS) installed on your network for server name-to-IP address resolution, you can also enter the server's DNS name instead of the IP address.

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3. Accept the SSL certificate.

You must have SSL 2.0 and SSL 3.0 (where available) enabled in your browser; otherwise, the browser displays an error indicating that the page cannot be displayed.

4. When the login dialog box appears, enter the ***username*** and ***password***.

Log in as user root, as a local Linux user, or as an eDirectory user that is Linux User Management (LUM) enabled (such as Admin).

If LUM is enabled in your tree and installed and configured on the local server, you can log in to NRM using your eDirectory credentials.

If you log in as a local Linux user or as a non-Admin eDirectory user, you can see only the information that the user you log in as has rights to view.

Remember the following when logging in as an eDirectory user to NRM:

- For users to log in as the Admin user or equivalent, Admin must either
  - Be associated to the group that has the Supervisor right for the Entry Rights property for the UNIX Workstation object

    or
  - Have the Supervisor right for the Entry Rights to the NCP™ object that represents the Linux server in the eDirectory tree

eDirectory users that have the Supervisor right to one of these objects have rights equivalent to Root on the Linux server.

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If eDirectory and LUM are installed on the local server, the admin user in eDirectory can log in to NRM using the fully distinguished name (such as **admin.slc.da**) because the user is LUM-enabled by default.

- For non-Admin users to log in using eDirectory credentials, they must be users enabled for LUM.

  Users that are LUM-enabled have a Linux Profile tab on their Modify User page in iManager and an eDirectory object that is associated with the UNIX Workstation object that represents the Linux server.

  You can use iManager or the LUM command line utility namuseradd to enable users for LUM.

After logging in, your session for NRM remains open until you close all your browser windows at that workstation.

How to Start or Stop Httpstkd

When you install Novell OES on Linux, NRM is installed and started by default.

A script for starting and stopping the NRM/Linux components is in /etc/init.d/novell-httpstkd.

You use the following commands to manage the novell-httpstkd daemon:

Table 3-10

Command	Action
rcnovell-httpstkd status *or* **/etc/init.d/novell-httpstkd status**	Displays the current status of the daemon.
rcnovell-httpstkd start *or* **/etc/init.d/novell-httpstkd start**	Starts the daemon.

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(continued) **Table 3-10**

Command	Action
rcnovell-httpstkd stop *or* **/etc/init.d/novell-httpstkd stop**	Stops the daemon.

How to View the HTTP Logs

The NRM Configuration Options page contains a link for all the HTTPSTK–related messages contained in the /var/log/messages file.

This information is valuable for seeing information such as who logged in through NRM, when they logged in, the pages being viewed, and log failures.

You can view the last 100 entries of the log or the entire log by doing the following:

1. Select the **Configure** icon at the top of the NRM page.
2. Under the HTTP Logs heading, select **View Last 100 Log Entries** or **View Entire Log**.

The logging to this file is controlled by the Syslog options. To change these options from the default, edit the /etc/sysconf/syslog file.

How to Manage an OES Linux Server from NRM

The Manage Linux section in NRM for Linux includes the following options:

- VNC Consoles
- View Kernel Modules
- View Memory Information
- Down/Restart

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- View Package Information
- View Process Information

VNC Consoles

If VNC services are configured on the server, you can access the VNC console screens by selecting the **VNC Consoles** link under the Manage Linux heading in the navigation frame; then select the **1024 X 728** button on the VNC Console Screens page.

If VNC services are not configured, you can configure them through YaST > Network Services > Remote Administration.

This form of remote administration is less secure than SSH; for this reason, we recommend using this feature only in a secure environment (such as behind a firewall).

Selecting the VNC Consoles link opens a Java applet in a secondary browser window. The following describes what you can do from this window:

Table 3-11

Task	Procedure
Use any of the screens listed as though you were at the server console.	Use the keyboard or mouse as though you were at the server console.
Disconnect from the console.	Select the **Disconnect** button on this page.
Change any of the VNC client options currently selected.	Select the **Options** button.
Access the VNC client clipboard and cut or paste any commands that you might want to execute in an active terminal shell.	Select the **Clipboard** button.
Restart the server.	Select the **Send Ctrl+Alt+Del** button.

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(continued) **Table 3-11**

Task	Procedure
Refresh the current screen you are viewing.	Select the **Refresh** button.

View Kernel Modules

The View Kernel Modules option displays the Kernel Module Listing page:

Figure 3-2

Kernel Module Listing

Kernel Module Information			
Name	**Memory**	**Use Count**	**Module Users/Configuration Info**
lp	11172	0	
parport_pc	35648	1	
parport	37832	2	lp parport_pc
nebdrv	9360	20	
nsslsa	60196	1	
nssmanage	94200	1	nsslsa
nsszlss	1008048	1	nssmanage
nssmal	20344	3	nsslsa nssmanage nsszlss
nsscomn	1166640	11	nsslsa nssmanage nsszlss
ndpmod	34744	5	nsslsa nssmanage nsscomn
nss	249108	5	nsslsa nssmanage nsszlss nssmal nsscomn
nsslibrary	673792	7	nsslsa nssmanage nsszlss nssmal nsscomn ndpmod nss
nsslnxlib	31880	3	nsszlss nsscomn nsslibrary
linuxmpk	109424	10	nebdrv nsslsa nssmanage nsszlss nssmal nsscomn ndpmod nss nsslibrary nsslnxlib

From this page you can view the status of the modules that have been compiled into the Linux kernel on this system.

Printing this page can be useful to document your system as you make changes or upgrades to it in the future.

The information shown on this page is equivalent to the information in the lsmod shell command plus the Live information or equivalent to viewing the /proc/modules file.

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View Memory Information

The View Memory Information option displays the View Memory Config page:

Figure 3-3

View Memory Config

Physical Server Memory		
In Use	523,161,600	RAM that is being used
Unused	7,598,080	RAM that is unused and available
Temporary Disk Block Buffers	35,684,352	Temporary storage for disk buffers
File System Cache	94,707,712	Temporary storage for files read from disk
Total System Memory	661,151,744	Total usable RAM
Swap Space In Use	138,780,672	Memory that has been temporarily moved to disk
Total Swap File Size	524,312,576	Total available swap space

From this page you can view the following information about the memory in the server (amount values are displayed in bytes):

- Used and unused amounts of physical memory
- Amount of memory in buffer cache
- Amount of memory used by the file system cache

  This value is determined by subtracting the SwapCache from the PageCache (disk cache) amounts.
- Amount of total memory that can be used by the system

  This value is determined by subtracting the physical RAM from the kernel binary code.
- Amount of swap space in use and available

  The Total Swap File Size link displays a Swap File Information page that provides a very quick snapshot of every swap filename, type of swap space, and total and used sizes (in kilobytes) on the server, including the following information:

  - The Priority column is useful when multiple swap files are in use and some of them are preferred over others (for example, if they are on faster hard disks).

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The lower the priority, the more likely the swap file will be used.

- The Active column shows a Yes or No status, indicating whether or not the Swap file is active. Selecting the link turns swapping on or off for the listed device.
- Two additional links turn swapping on or off for all devices.

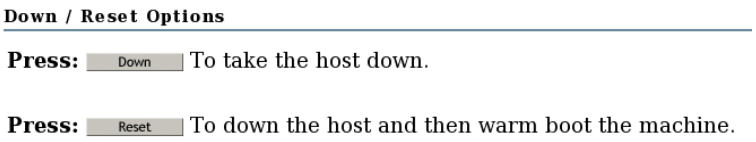
  If you add a swap file to a device, you need to add an entry to the /etc/fstab file to make the swapon or swapoff links work correctly.

  This information is also in the /proc/swaps file.

Down/Restart

The Down/Restart option displays the Down/Reset Options page:

Figure 3-4



You can use these options to shut down or reset the host. The following describes the specific actions of each option:

Table 3-12

Option	Action
Down	Forces the host to shut down immediately.
Reset	Forces the host to shut down immediately, then warm boots the computer.

Using either of these options also forces the host server to perform the following actions:

- Update the cache buffers to disks
- Close all open files

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If files are open and changes have not been saved to the host, some data loss might occur. Users might need to save changes locally until the host is started again.

- Update the appropriate file system tables
- Exit the host from the network
- Unmount all file systems

View Package Information

The View Package Information option displays the Package Information page:

Figure 3-5

Package Information

Package Information		Install
Name	**Group**	**Version**
3ddiag	System/Base	0.716
aaa_base	System/Fhs	9
aaa_base_novell	System/Fhs	0.0.1
aaa_skel	System/Fhs	2004.6.8
aalib	System/Libraries	1.4.0
acl	System/Filesystems	2.2.21

From this page you can view the following information about each package that is installed on the system:

- Name
- Group

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- Version
- Release
- Vendor

From the View Package Information page (and subsequent pages), you can perform the following tasks:

Table 3-13

Task	Steps
Sort the listed packages by name, group, or vendor.	Select the sort icon (a red triangle) at the top of the applicable column.
View more detailed information about an installed package.	Select the link for the package under the name column.
Remove an installed package.	Select the link for the package under the name column; then select **Remove**.
Install a new package that you have downloaded to the host.	Select **Install** and browse to the location where you uploaded the package. Select the package; then select **Install**. The selected package's file path is transferred to the RPM File Path field on the Package Installation page. When you select the Install button on the View Package Information page, NRM attempts to install the specified RPM file using the Linux RPM utility.

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View Process Information

The View Process Information option displays the Process Information page:

Figure 3-6

Process Information

Stop Refresh

Process Information			
Name	ID (Status)	CPU Usage %	Memory Usage (%)
adminusd	22349 (Sleep)	0.000000%	1,593,344 (0.2%)
adminusd	31051 (Zombie)	0.000000%	0 (0.0%)
aio/0	10 (Sleep)	0.000000%	0 (0.0%)
artsd	1592 (Sleep)	0.000000%	4,186,112 (0.6%)
cron	9549 (Sleep)	0.000000%	667,648 (0.1%)
dhcpd	7053 (Sleep)	0.000000%	1,187,840 (0.1%)
events/0	3 (Sleep)	0.000000%	0 (0.0%)
firefox	25325 (Sleep)	0.000000%	1,269,760 (0.1%)
firefox-bin	25341 (Sleep)	0.000000%	30,842,880 (4%)
gconfd-2	18367 (Sleep)	0.000000%	4,194,304 (0.6%)
httpd2-worker	10365 (Sleep)	0.000000%	3,813,376 (0.5%)
httpd2-worker	10366 (Sleep)	0.000000%	3,674,112 (0.5%)
httpd2-worker	4829 (Sleep)	0.000000%	6,205,440 (0.9%)
httpd2-worker	30983 (Sleep)	0.000000%	5,812,224 (0.8%)
httpstkd	5589 (Sleep)	0.000000%	6,230,016 (0.9%)
hwscand	2379 (Sleep)	0.000000%	319,488 (0.0%)
idbrokerd	21454 (Sleep)	0.000000%	4,055,040 (0.6%)

From this page, you can view a list of all the processes, as well as their state in the host, and perform the actions listed in the following:

Table 3-14

Task	Steps
Sort the process by name (in alphabetical order by default), by process ID, by CPU Usage, or by Memory Usage.	Select the sort icon (a red triangle) at the top of the applicable column.

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(continued) **Table 3-14**

Task	Steps
View more specific information about a listed process.	Select the link for the applicable process under the name column.
Kill a process.	Select the link for the applicable process under the name column; then select **Kill**.

How to Configure Groups and Group Operations

Novell Remote Manager lets you build and configure groups of items for monitoring Linux server or NetWare server health and providing various statistics for servers running other operating systems.

A few of the preconfigured monitoring item types include

- NRM Health Status for a single server or a group of servers
- Ping to a specific port
- IP connectivity
- LDAP Directory Root Search
- Status of connectivity to a web page

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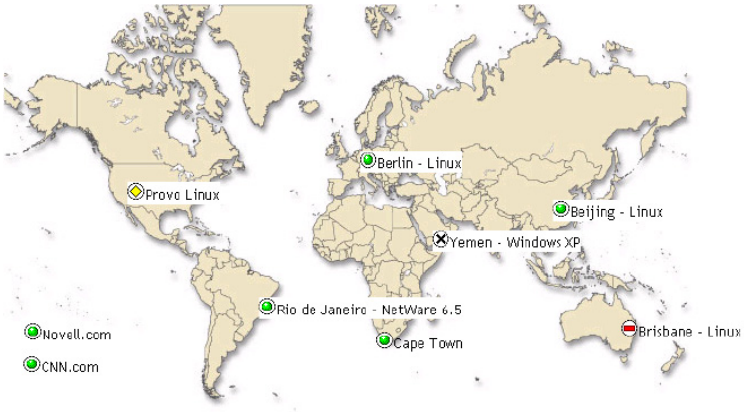
Monitoring items can be defined and represented by icons on a page as shown in the following:

Figure 3-7



The icons can represent a single item or a group of items.

The Groups feature is available on both OES NetWare and OES Linux versions of NRM.

In this objective, you are introduced to the following group configuration tasks:

- Build and Configure a Group
- Save a Group
- Access an Existing Group
- Delete a Group

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For complete information on configuring Groups from NRM, refer to “Using Group and Group Operations” on page 113 in the *Novell Remote Manager for NetWare Administration Guide* (remotemgr.pdf) or “Using Group Operations” on page 63 in the *Novell Remote Manager Administration Guide for Linux* (remotemgr_lx.pdf).

You can access these guides from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

Build and Configure a Group

To build and configure a new monitor group, do the following:

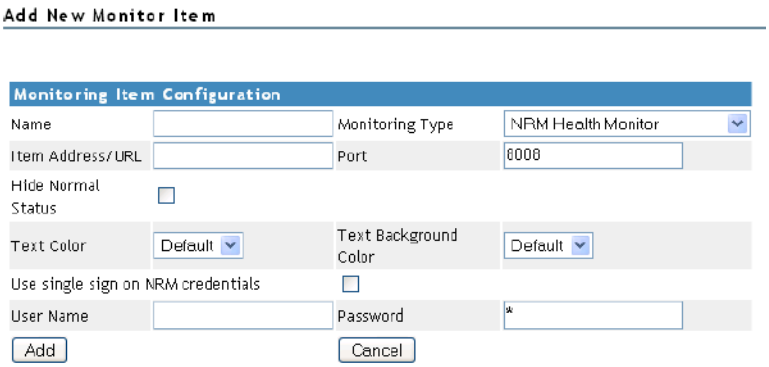
1. From the left side of the NRM web page, select **Configure New Group**.
2. Right-click the Group Monitoring Operations page.

   If your browser does not support right-click functionality, double-click the **Reports** icon in the upper-right corner of the page.

3. Select **Add Item**.

   The Add New Monitor Item page appears:

Figure 3-8



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The following describes the available options:

Table 3-15

Option	Description
Name	Provide a descriptive name for the item.
Monitoring Type	Select one of the following types from the drop-down list: ■ **Label.** Text information to use as a label on the group monitor display. Lets you identify each group specifically as needed. ■ **LDAP Directory Root Search.** Shows the response when trying to ping port 389 of the specified LDAP server. Credentials are not used. This is useful to monitor the status of your LDAP servers in your network. ■ **NRM Group.** Shows the health status of a group of servers. Lets you access the specific health page for each server in the group. ■ **NRM Health Monitor.** Shows the health status of each server in the group. Lets you access the specific health page for each server in the group. ■ **ICMP Echo (Ping)** or **Ping (ICMP).** Shows the response when sending ping requests to the specified DNS name or IP address. ■ **TCP/IP Service Query** or **TCP/IP Port Query.** Shows response activity of a designated TCP/IP service. This query attempts to make a TCP connection to the specified address and port. The only states that are returned are green (good), which means the connection was successful, and red (bad), which means the connection was not successful.

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(continued) **Table 3-15**

Option	Description
Monitoring Type (*continued*)	■ **Download Web Page** or **Web Page.** Shows the response when trying to download a Web page from the specified URL. You only need to type the second part of the address.
Item Address/URL	Specify the IP address for the server that you want to monitor or ping, or specify the URL for the web page that you want to download. The address can be an IP address or DNS name. You do not need to specify the HTTP:// portion of a URL.
Hide Normal Status	When selected, only items that are in an abnormal state are displayed. If you want to monitor all statuses, leave the check box deselected.
Text Color	Black is the default. You can select any other color from the drop-down list.
Port	The default is provided. You can type a different port to use.
Use Single Sign on NRM Credentials	When selected (default), the credentials used to access this item's data are the same as the credentials that the user logged in to Novell Remote Manager with. When deselected, enter the credential necessary to access the item in the User Name and Password fields.
Text Background Color	Clear is the default. You can select any other color in the drop-down list.

4. When you finish, select **Add**; then drag the monitor item to the desired location (on the map).
5. Repeat Steps 3 and 4 for each item that you add.

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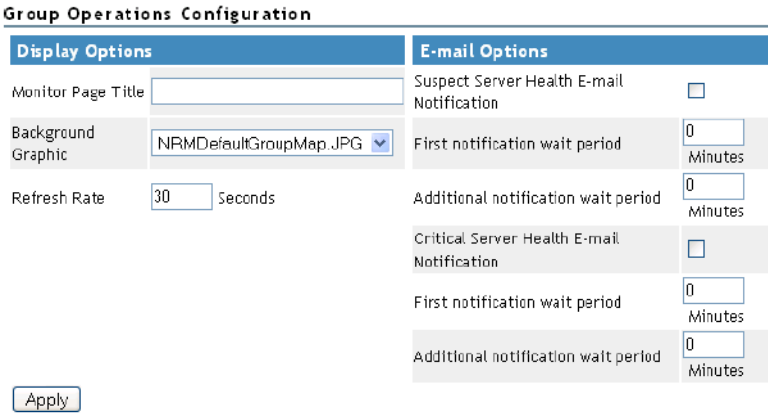
6. (Optional) You can change any of the following group configurations:
   - The label for the group
   - The graphic displayed
   - The refresh rate
   - The suspect and critical email notification for the group
7. Right-click the customized Group page; then select **Group Configuration**.

   The Group Operations Configuration dialog appears:

Figure 3-9



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The following describes the available options:

Table 3-16

Option	Description
Display	The display options let you control the following: ■ **Monitor Page Title.** Specify a title to be shown at the top of the monitor page in the header area when the page is built. ■ **Refresh Rate.** Specify the number of seconds between status queries to the server. ■ **Background Graphic.** Select a graphic from the drop-down list for the monitor items to be displayed on. This option can be helpful if you want to show specific locations of the item being monitored. If you want to add a customized graphic, add it to the sys:\login\nrmgroupmaps directory (OES NetWare) or the /opt/novell/nrm/NRMGroupMaps directory (OES Linux).
Email	The email notification options control how and when email notifications are sent when the server health changes. Email notifications are sent to the addresses in the mail notification list using the mail servers set in the /etc/opt/novell/httpstkd.conf file (OES Linux) or the mail servers set on the Mail Notification Configuration page (OES NetWare).

8. When you finish, select **Apply**.
9. Perform the desired task, or save the group and perform the task later.

   In this release, the only task you can perform on Linux servers is to compare the server up times.

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10. (Optional) If you want to reuse the group, you must save it by selecting **Save Group** and completing the steps listed under "Save a Group" on 3-55.

Save a Group

You can save the configuration of the group so you can access this page again without completing the configuration options by doing one of the following:

- Save the Group to the Local Server

  or

- Save the Group and Associate It with an eDirectory Object

Save the Group to the Local Server

Do the following:

1. While viewing the group you just created or edited, right-click the customized Group page; then select **Save Group**.
2. In the Group Name field, enter a name for the group or select a group name that you want to replace from the group list.

   Use a name that represents the group you built.
3. Select **Save Group**.

   This saves the group to a file with that name in the /opt/novell/nrm/NRMGroups directory (OES Linux) or the sys:\login\nrmgroups directory (OES NetWare).

Save the Group and Associate It with an eDirectory Object

You can save a group and associate it with a user or group eDirectory object. This is helpful when you want to access the configuration and you don't want to save the configuration to a specific server.

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For example, storing the configuration in an eDirectory object is important if the server is down but you want it to be part of the operation or if you want to run the operation while one of the servers is not functioning properly.

Only one group can be associated to an object.

To save the group configuration with a user or group eDirectory object, do the following:

1. While viewing the group you just created or edited, right-click the customized Group page; then select **Save Group**.
2. In the Make This the Group Monitor for This Object field, specify a user or group object that you want to associate the group configuration with.

   You can browse to the user or group by selecting the **Browse** icon or by typing the full context name of the object.
3. When you finish, select **Save Group**.

Access an Existing Group

After a group has been saved to the server, you can access the group again to run reports or change the attributes of the group by doing the following:

1. From the NRM navigation frame (on the left), select **Select Group**.
2. From the Server Group page, select the desired group from the drop-down list.

   In this release, browsing for a group configuration file previously saved is not working even though the option exists on the page.
3. Select **Build Group**.

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Delete a Group

To delete a group, do the following:

1. From the NRM navigation frame (on the left), select **Select Group**.
2. From the Server Group page, select the desired group from the drop-down list.
3. Select **Delete Group**.

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Exercise 3-2 Monitor the Status of Your OES Servers with Novell Remote Manager (NRM)

In this exercise, you use NRM to monitor the health of your OES servers and create a server group for easier access to health statistics by doing the following:

- Monitoring the status of the OES servers
- Configuring a server monitoring group

Exercise 3-2 Monitor the Status of Your OES Servers with Novell Remote Manager (NRM) is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 3-8.

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Objective 3 Monitor eDirectory Trees on OES with Novell iMonitor

Novell iMonitor provides cross-platform monitoring and diagnostic capability to all servers in your eDirectory tree. This utility lets you monitor your servers from any location on your network where a web browser is available.

iMonitor lets you look at the eDirectory environment in depth on a partition, replica, or server basis. You can also examine what tasks are taking place, when they are happening, what their results are, and how long they are taking.

You can use iMonitor to monitor the following versions of Novell Directory Services (NDS®) and eDirectory:

- All versions of NDS and eDirectory for NetWare 4.11 or later
- All versions of NDS and eDirectory for Windows
- All versions of NDS and eDirectory for Linux, Solaris, AIX, and HP-UX

The information you view in iMonitor immediately shows what is happening on your server. And because iMonitor relies on eDirectory (instead of OS-specific features), the same options are available across all supported platforms (including Linux).

In this objective, we assume that you already know how to use iMonitor for NetWare servers. However, you might need to review the following information specific to using iMonitor in a mixed OS eDirectory tree with servers such as OES NetWare and OES Linux:

- Novell OES iMonitor Features
- System Requirements
- How to Access iMonitor
- Novell Remote Manager Integration

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For complete information on iMonitor 2.1, refer to “Using Novell iMonitor 2.1” on page 163 in the *Novell eDirectory 8.7.3 Administration Guide* (edir873.pdf).

You can access this guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

Novell OES iMonitor Features

iMonitor's features are primarily server focused, meaning that they focus on the health of individual eDirectory agents (running instances of NDS for the replica on the local server) rather than the entire eDirectory tree.

iMonitor 2.1 (included in Novell OES) provides the following features:

- eDirectory health summary:
  - Synchronization information
  - Known servers
  - Agent configuration
- eDirectory health checks
- Hyperlinked DSTrace
- Agent configuration
- Agent activity and verb statistics
- Reports
- Agent information
- Error information
- Object/schema browser
- DirXML® monitor
- Search
- Partition list

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- Agent process status
- Background process schedule
- DSRepair
- Connection monitor

The information you can view in iMonitor is based on the following factors:

- **The identity you have established.** Your identity's eDirectory rights are applied to every request you make in iMonitor.

  For example, you must log in as the administrator of the server or as a console operator on the server where you are trying to access the DSRepair page.

- **The eDirectory agent version you are monitoring.** Newer versions of NDS and eDirectory have features and options that older versions do not.

You can use iMonitor to monitor all versions of NDS and eDirectory for NetWare 4.11 or later.

System Requirements

To use iMonitor 2.1, you need the following:

- Mozilla Firefox 1.0, Microsoft Internet Explorer 5.5 or later, Mozilla 1.7 (SLES 9 SP1 and Linux Professional 9.2), or Netscape 7.02 or later
- Novell eDirectory 8.7.1 or later

iMonitor 2.1 runs on the following platforms:

- NetWare 5.1 Support Pack 4 or later

  Novell iMonitor is placed in autoexec.ncf.

- Windows NT, 2000, and 2003 Server (No SSL)
- Linux
- Solaris

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- AIX
- HP-UX

For NetWare and Windows, iMonitor loads automatically when eDirectory runs.

On Linux, Solaris, AIX, and HP-UX, you can load iMonitor using the **ndsimonitor -l** command.

It can also be loaded automatically (as in OES Linux) by adding **[ndsimonitor]** in the /etc/ndsimon.conf file before you restart the eDirectory server.

How to Access iMonitor

To access Novell iMonitor, do the following:

1. Make sure that the iMonitor executable is running on the eDirectory server.

   If you installed eDirectory on your OES Linux server or installed OES Linux into an existing eDirectory tree, iMonitor is already running on the OES Linux server.

2. Open a supported Web browser.

3. In the address (URL) field, enter the following:

   http://*server_IP_address*:*httpstack_port*/nds

   The following ports are available for iMonitor:

   - OES NetWare: **8008** (non-secure) and **8009** (secure)
   - OES Linux: **8028** (non-secure) and **8030** (secure)

   For example, if the server IP address is 10.0.0.4 and the port number for httpstack is 8030 (the secure port on an OES Linux server), you would enter the following:

   https://10.0.0.4:8030/nds

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If you forget which ports (non-secure and SSL) are assigned to iMonitor, you can find and display the information from the ndsconfig file by entering **ndsconfig get | grep http** at a shell prompt.

You can also use DNS names anywhere a server's IP or IPX address or distinguished name can be used.

For example, with DNS configure,

http://prv-gromit.provo.novell.com/nds?server=prv-igloo.provo.novell.com

is equivalent to

http://prv-gromit.provo.novell.com/nds?server=*IP_or_IPX address*

or

http://prv-gromit.provo.novell.com/nds?server=/cn=prvigloo, ou=ds,ou=dev,o=novell,t=novell_inc

If an eDirectory HTTPS stack is available, you can use iMonitor through HTTPS.

4. From the login page, enter a ***username*** and ***password***.

   To access all of the features, you need to log in as Admin or as an administrator equivalent.

   If you have more than one Admin user object in the tree with the same name, make sure you include the fully distinguished name to log in as the correct user.

5. Select **Login**.

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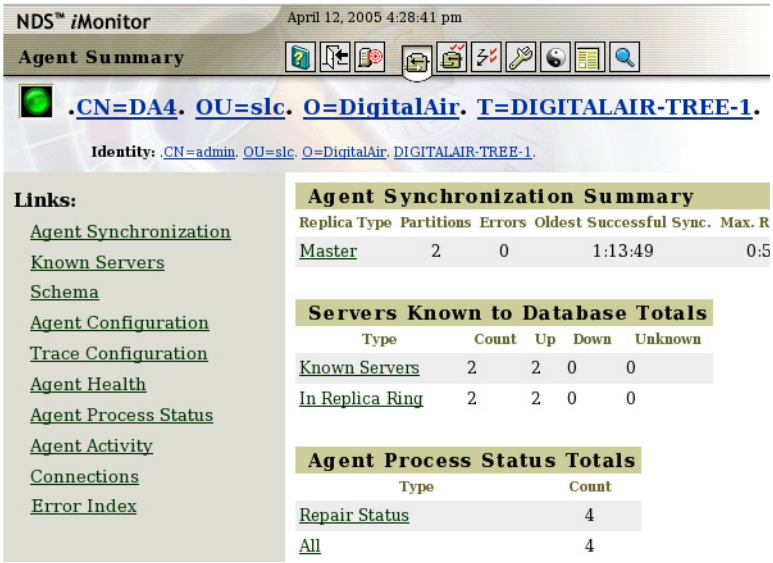
The iMonitor page appears:

Figure 3-10



Novell Remote Manager Integration

On NetWare 5 and later servers, a link to NRM provides you with Web-based monitoring, diagnosis, and troubleshooting information for NetWare servers.

iMonitor is integrated with NRM in the following ways:

- NRM's lightweight web server (httpstk.nlm) provides the first layer of the iMonitor architecture on the NetWare platform.
- iMonitor registers with NRM (portal.nlm) so that links to iMonitor and other eDirectory-specific information are available through the NRM interface.

  These links are found under the Manage eDirectory section in the Remote Manager interface.

  Links to eDirectory agent health information are also found in the Diagnose Server section under Health Monitor in the eDirectory-related categories.

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NRM also registers with eDirectory, which allows iMonitor and NRM to cross-reference each other for a more seamless movement between each tool.

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Exercise 3-3 Check the Status of Your eDirectory Trees with iMonitor

In this exercise, you use iMonitor from the Windows XP desktop to check the status of the DA-CORP eDirectory tree on the DA2 NetWare server and the DA-SERVICES tree on the DA1 Linux server.

Exercise 3-3 Check the Status of Your eDirectory Trees with iMonitor is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 3-15.

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Objective 4 Manage Novell OES Servers with Novell iManager

Novell iManager is an administration console that provides secure, customized access to network administration utilities and content from virtually anywhere you have access to the Internet and a web browser.

In this objective, we assume that you already know how to use previous versions of Novell iManager but are not familiar with Novell iManager 2.5 and need some help getting started with running iManager from a Linux server.

This objective provides information on the following topics:

- What's New in Version 2.5
- How to Access iManager
- How to Initially Configure RBS
- How to Configure RBS Roles
- How to Customize Novell iManager
- How to Monitor Server Health

For complete information on Novell iManager 2.5, refer to the *Novell iManager 2.5 Administration Guide* (imanager_admin_25.pdf).

You can access this guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

What's New in Version 2.5

Novell iManager 2.5 provides the following new features:

- Improved installation programs
- Enhanced group management capabilities
- Backward compatibility with most iManager 2.0.*x* plug-ins

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- Enhanced Role-Based Services (RBS) management and reporting
- Improved interface customization options
- Mobile iManager software, which allows you to run iManager locally on a Linux or Microsoft Windows workstation

How to Access iManager

To access iManager, you need to know the following:

- Supported Web Browsers
- How to Start iManager
- Access Modes

Supported Web Browsers

For iManager access and complete use of all its features, you must use a computer running one of the following web browsers:

- Microsoft Internet Explorer 6.0 SP1
- Mozilla 1.7
- Mozilla Firefox 1.0

Although you might be able to access iManager via a web browser not listed, Novell does not guarantee or support full functionality with any browser other than those listed above.

How to Start iManager

To start Novell iManager, do the following:

1. From a supported web browser, enter the following in the address (URL) field:

   https://*server_IP_address*/nps/iManager

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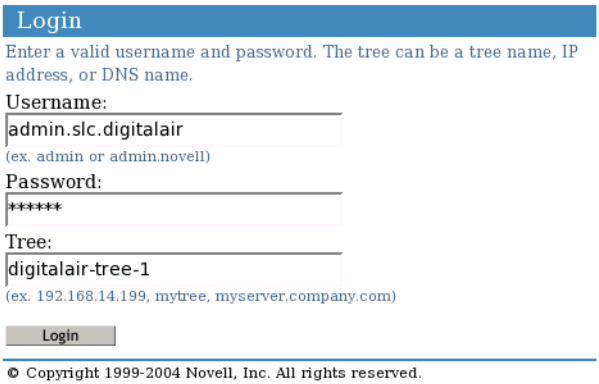
For example, if your server IP address is 10.0.0.4, you would enter the following:

https://10.0.0.4/nps/iManager

You might be redirected to an HTTPS (secure) page, depending on your platform.

A Login page appears:

Figure 3-11



2. Log in with a ***username*** and ***password***.

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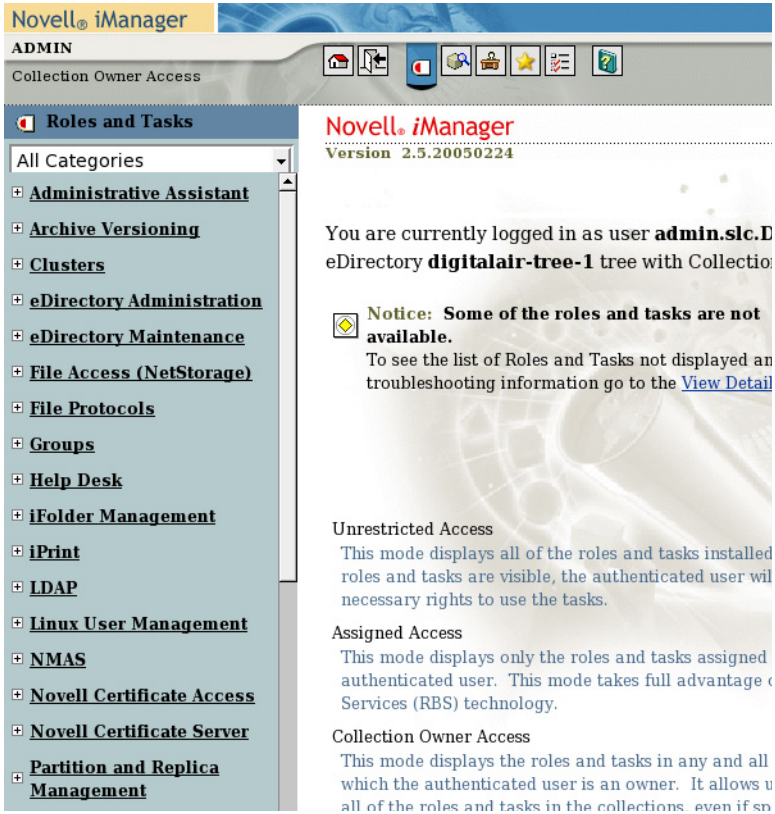
The Novell iManager default page appears:

Figure 3-12



You will have access only to those features you have rights to. To have full access to all Novell iManager features, you must log in as administrator of the tree.

If eDirectory is installed and running on another port besides the default port 524, you can use the IP address or DNS name of the eDirectory server to log in if you also specify the port.

If you use the tree name to log in, you do not have to specify a port. Possible values for the Tree Name field are tree name, server IP address, and server DNS name.

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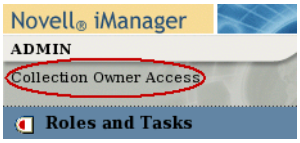
Access Modes

When you start iManager, you are granted an access mode based on the rights you've been assigned. The mode you are in is displayed in the upper left corner of the iManager interface:

Figure 3-13



iManager provides the following access modes:

- **Unrestricted Access.** This is the default mode before RBS is configured. It displays all of the roles and tasks installed.

  Although all roles and tasks are visible, the authenticated user still needs the necessary rights to use the tasks.

- **Assigned Access.** Displays only the roles and tasks assigned to the authenticated user. This mode takes full advantage of the RBS technology.

- **Collection Owner Access.** Displays all of the roles and tasks installed in the collection.

  This mode lets you use all of the roles and tasks in the collection, even if specific rights have not been assigned. RBS must be installed in order to use this mode.

The collection owner sees all roles and tasks, regardless of role membership.

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How to Initially Configure RBS

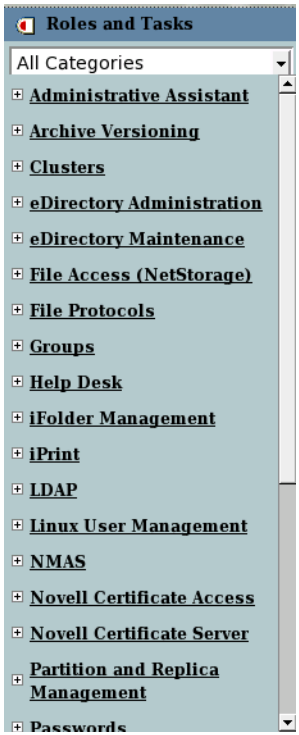
iManager gives you the ability to assign specific responsibilities to users and to present them with the tools (and their accompanying rights) necessary to perform only those sets of responsibilities.

This functionality is called Role-Based Services (RBS) and is a set of extensions to the eDirectory schema.

You can use RBS to create specific roles within your organization; the roles contain tasks that a user performs. You can assign a role to a user who then performs the tasks within iManager, such as creating a new user or changing a password.

When iManager is installed in connection with Novell OES, various roles and tasks are configured and listed in the navigation panel of iManager:

Figure 3-14



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While these roles and tasks are listed, some are not available to the Admin user until you run the iManager configuration wizard. After that, all listed roles and tasks are available only to the Admin user and other users or groups you specifically designate.

To perform this initial configuration with the iManager configuration wizard, do the following:

1. Start iManager and log in as a user with administrator rights (such as Admin).
2. At the top of the iManager page, select the **Configure** icon.
3. From the left pane, select **Role Based Services > RBS Configuration**.
4. At the top of the RBS Configuration page, select **Configure iManager**.

   This starts the iManager configuration wizard.
5. From the iManager Configuration welcome page, continue by selecting **Next**.
6. Follow the prompts and dialogs to complete the initial configuration and update the modules.
7. After the modules are updated, select **Close**.

How to Configure RBS Roles

With RBS, tasks are preassigned to roles, but these tasks can be replaced, reassigned, or removed altogether.

In addition, users are associated with roles in a specified scope, which is a container in the tree in which the user has the requisite permissions to perform a task.

An RBS Role object creates an association between users and tasks. An administrator grants a user access to a task by making the user a member of the role to which the task is assigned.

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A user can be assigned to a role in the following ways:

- Directly as a user
- Through group and dynamic group assignments

  If a user is a member of a group or a dynamic group that is assigned to a role, then the user has access to the role.
- Through organizational role assignments

  If a user is an occupant of a organizational role that is assigned a role, then the user has access to the role.
- Through container assignment

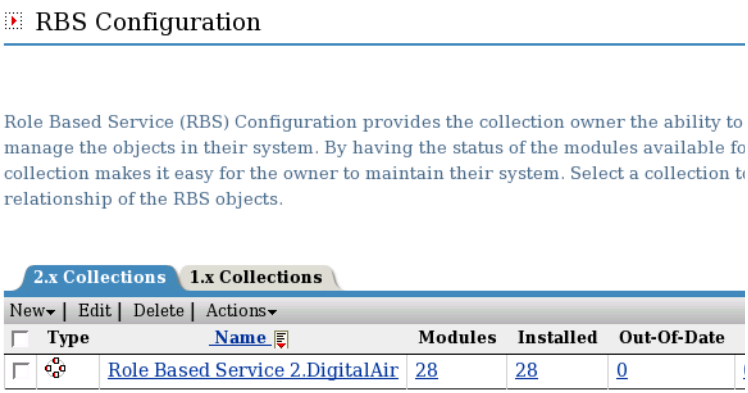
  A user object has access to all of the roles that its parent container is assigned. This could also include other containers up to the root of the tree.

A user can be associated with a role multiple times, each with a different scope.

The RBS Configuration task provides complete control over RBS objects. It is a central place for managing and configuring RBS objects.

When you select **Role Based Services > RBS Configuration**, the following page appears:

Figure 3-15



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The RBS Configuration page lets you list and modify RBS objects by type, and gives you useful information about the RBS system, such as

- The number of modules in a collection
- How many modules are installed or not installed
- How many modules are outdated

For some operations you can configure multiple objects at the same time. For example, you can associate multiple members with a role at the same time.

If RBS Services has not yet been configured on iManager, you can select the link on the RBS Configuration page and follow the displayed instructions.

The following tabs appear on the RBS Configuration page:

- **2.*x* Collection.** This is the current collection of RBS objects.
- **1.*x* Collection.** This is the older collection of RBS objects that you can either delete or migrate to 2.*x*.

  If you select **Migrate**, a wizard steps you through the migration process.

You only see the collections you own:

- **Modules** indicates the number of modules on the Web server that you are logged in to.
- **Installed** lists the modules that are currently installed. Outdated modules are listed, as well as modules that are available but not installed.

You can create a new iManager role or new eGuide role on this page, and explore the content. You can also delete roles.

Under Actions, you can set a member association, define its scope, and set rights (Inherited) from that scope down to that subtree. If this option is not selected, then rights are limited to the container.

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Exercise 3-4 Configure Role-Based Services

In this exercise, you use iManager to configure roles and tasks for the DA-CORP eDirectory tree by

- Configuring Role-Based Services
- Modifying the Help Desk role

Exercise 3-4 Configure Role-Based Services is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 3-20.

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How to Customize Novell iManager

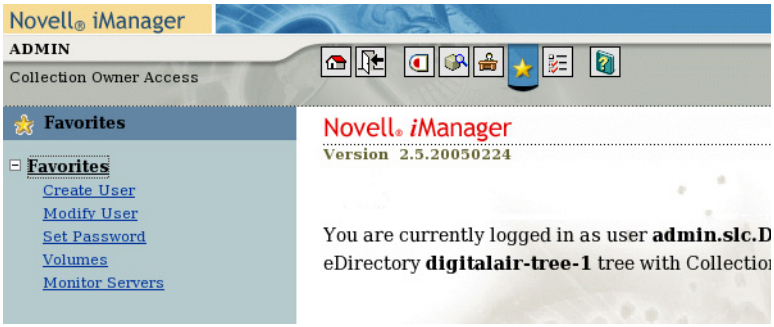
The following options on the Configure page of Novell iManager let you customize iManager for your personal use:

- Favorites
- Look and Feel
- Plug-In Studio

Favorites

The Favorites button (gold star) at the top of the iManager page displays your most frequent tasks:

Figure 3-16



You can select the tasks you want to appear by doing the following:

1. From the top of the iManager page, select the **Preferences** button (looks like a bulleted list).
2. From the left under **General**, select **Manage Favorites**.

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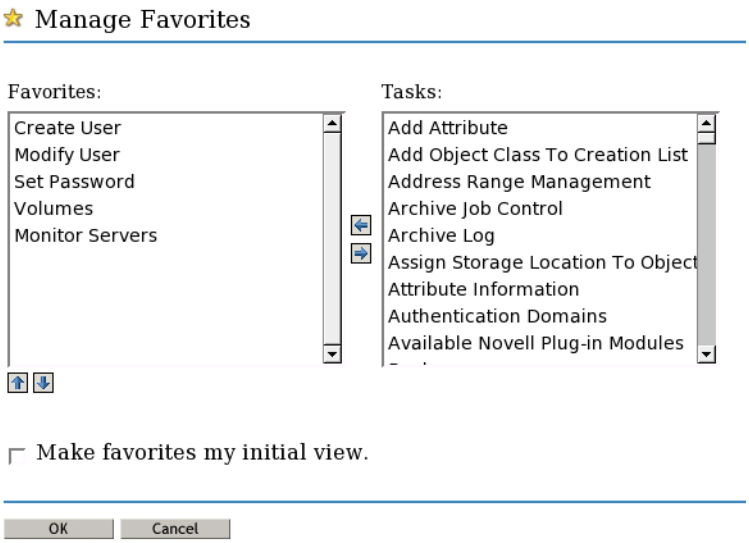
The following appears:

Figure 3-17



3. From the Tasks list, select a ***task*** you want to include with your favorites; then select the **left arrow**.
4. (Optional) You can set the Favorites page as your default view after logging in by selecting **Make favorites my initial view**.
5. When you finish, select **OK**.

Look and Feel

You can use the Look and Feel configuration page to customize the appearance of the iManager interface.

To change the look and feel of iManager, do the following:

1. From the top of the iManager page, select the **Configure** icon.
2. From the left pane, select **iManager Server > Configure iManager**.

   A Configure iManager page appears with several tabs.

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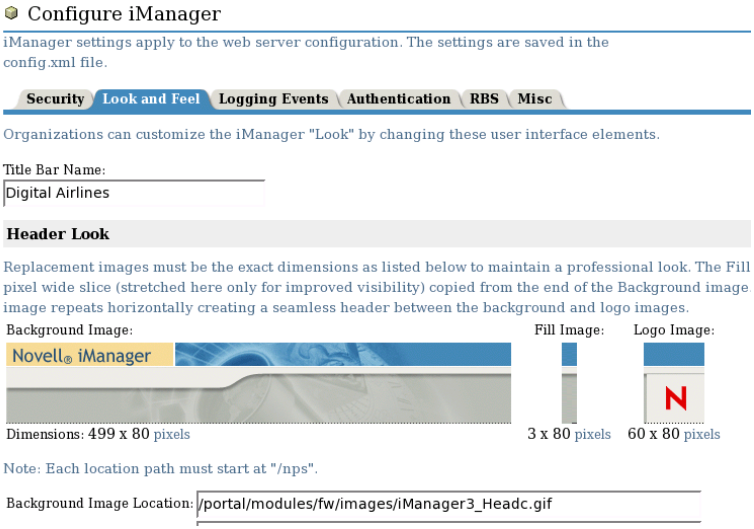
3. Select the **Look and feel** tab.

   The following appears:

Figure 3-18



From the Look and Feel configuration page, you can use the following options:

- **Title Bar Name.** Type your organization name in this text box. It will appear in the title bar of the Web browser in place of the default text, Novell iManager.
- **Images.** The Title bar contains three images:
  - The header background image
  - The header filler image
  - The header branding image

  Your own images must conform to the dimensions given on the interface.

  Store these files in nps/portal/modules/fw/images. Type the path of each image in its respective text field.

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- **Navigation Menu Colors.** You can customize the color of the menu header and the background of the navigation menu on the left.

  You can type either color names or hexadecimal numbers. Entries do not need to be case sensitive.

  Select **Reset** to change your color selections.

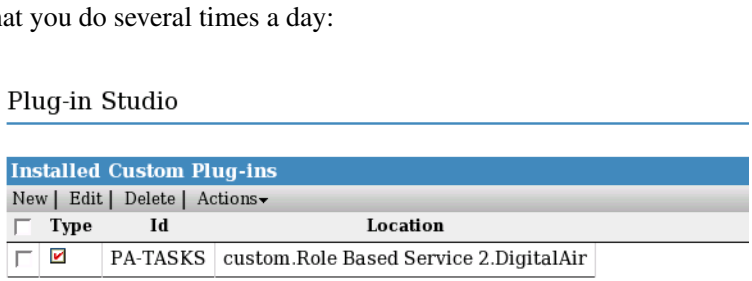
4. When you finish making changes, select **Save**.

   The settings are saved in the /var/opt/novell/iManager/nps/WEB-INF/config.xml file (OES Linux) or in the SYS:\tomcat\4\webapps\nps\WEB-INF\config.xml file (OES NetWare).

Plug-In Studio

Plug-In Studio offers a quick and easy way to streamline the tasks that you do several times a day:

Figure 3-19



You can use Plug-in Studio to dynamically create tasks for your most frequently used operations. You can also edit and delete tasks.

For example, to modify a user, instead of selecting Modify Object, you can create a dynamic user interface to edit only the attributes you have selected (such as first name or title).

Data is stored in the SYS:\tomcat\4\webapps\nps\portal\modules\custom directory (OES NetWare) or in the /var/opt/novell/webapps/tomcat4/webapps/nps/portal/modules/custom directory (OES Linux).

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To use the Plug-In Studio, you need to know how to do the following:

- Create a Plug-In Task
- Edit a Plug-In Task
- Delete a Plug-In Task

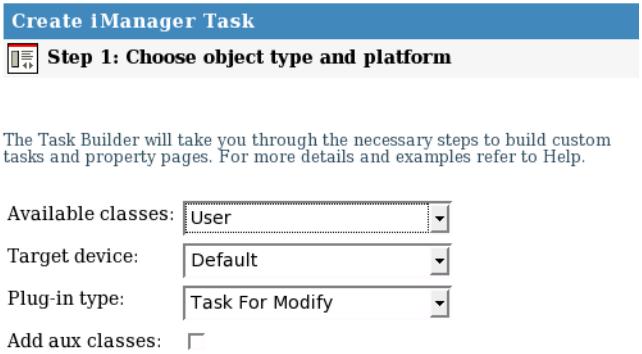
Create a Plug-In Task

To create a new task, do the following:

1. From the Configure page in iManager, select **Role-Based Services > Plug-in Studio**.
2. Select **New**.

   The Create iManager Task wizard appears to help you build custom tasks and property pages:

Figure 3-20



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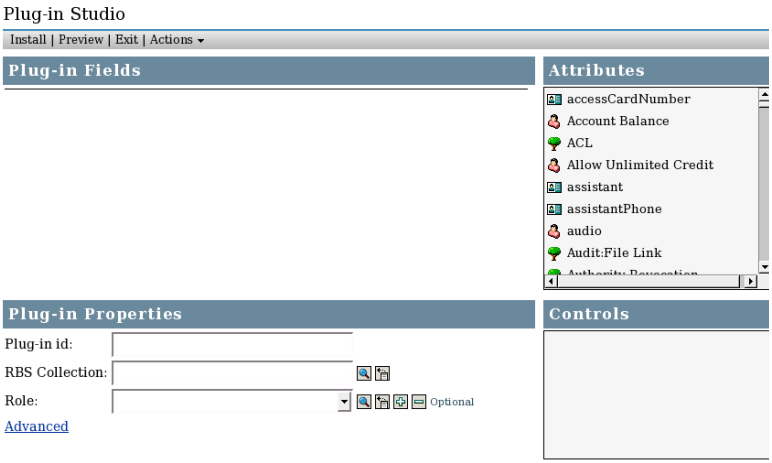
3. Select an ***object type*** and ***platform*** by entering information in the following fields:
   - Available classes (select an eDirectory class)
   - Target device: **Default** (supported browsers), **Browser** (IE), or **Pocket**.
   - Plug-in type: **Task for Modify**, **Property Book Page**, **Task for Create**, **Task for Delete**
   - Add Auxiliary Classes (include eDirectory auxiliary classes)
4. When you finish, continue by selecting **Next**.

   The following appears:

Figure 3-21



5. In the Plug-in Studio page, select or enter the following:
   - **Attributes.** Select an attribute from the list of available attributes for the selected object class.

     Select the attribute to list all available controls for that attribute. Double-click the attribute to accept the default control and move it to the plug-in field.

     There are three icons beside a selected control:
     - The flashing red icon indicates a required field.

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Select the icon to add available values; then select **OK**. The icon stops flashing.

- The down arrow lets you change a control.

  This is the same control that is displayed when you clicked the attribute. Change it to any available control for the selected attribute.

- The third icon deletes the attribute.

- **Controls.** This box lists your attribute selection.
- **Plug-in Properties.** Below Plug-in Properties, in the left area of the page, assign an ID to the plug-in and assign the task to an RBS collection.

  Open the Object Selector to find the RBS collection. Assign the task to a role. The role you assign determines where it appears in the Roles and Tasks screen.

  For example, if you choose User Management, select **Preview** and a new browser window opens. Preview the task to verify your design choices. Close the preview.

6. When you finish, select **Install** (top of the page).

   iManager dynamically builds the .xml file, the .jsp file, and the Java files that execute the task, and installs it into the system.

Edit a Plug-In Task

To edit a plug-in task, do the following:

1. From the Configure page in iManager, select **Role-Based Services > Plug-in Studio**.
2. Select the task; then select **Edit**.
3. Modify the settings described in “Create a Plug-In Task” on 3-81; then select **Install**.

   A confirmation message appears indicating that the plug-in was successfully created and installed.

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Delete a Plug-In Task

To delete a plug-in task, do the following:

1. From the Configure page in iManager, select **Role-Based Services > Plug-in Studio**.
2. Select the task; then select **Delete**.

   A warning message appears asking if you are sure you want to delete the plug-in.
3. Delete the plug-in task by selecting **OK**.

   A confirmation message appears indicating that the plug-in was successfully deleted.

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Exercise 3-5 Customize Novell iManager

In this exercise, you learn how to customize iManager to meet your specific administrative needs by doing the following:

- Creating iManager favorites
- Customizing the iManager look and feel
- Customizing iManager with the Plug-in Studio

Exercise 3-5 Customize Novell iManager is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 3-25.

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How to Monitor Server Health

Novell Health Monitoring Services (HMS) is a component provided in Novell OES that lets you monitor the health of Linux or NetWare operating systems using Web-Based Enterprise Management (WBEM).

For details on WBEM, see http://www.dmtf.org/standards/wbem.

WBEM is a set of management and Internet standard technologies developed to unify the management of enterprise computing environments.

The goal of WBEM is to provide customers with the ability to manage all systems, regardless of their instrumentation type, using a common standard.

OpenWBEM is an implementation of the specifications provided by the Distributed Management Task Force (DMTF).

For details on OpenWBEM, see the *OpenWBEM Services Administration Guide for OES* (cimom.pdf) or http://www.openwbem.org.

You can access this guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

HMS includes a plug-in for iManager that provides an interface for monitoring the health of Linux or NetWare operating systems through OpenWBEM.

The level of monitoring increases for hosts that are running OpenWBEM and the HMS providers.

This is the first release of these services by Novell. When these services are complete, you can gather data, analyze it, set up system alerts, and perform any actions needed.

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In this release, these services only let you collect data and do some analysis. You can obtain definitions of the analysis and action recommendations in the online help.

In future releases, you will be able to configure thresholds and system alerts. Analysis and action recommendations will be made by the system.

To perform basic Health Monitoring Services tasks, you need to know the following:

- Novell HMS Components
- Types of Health Monitoring
- Platform Compatibility
- How to Access HMS
- How to Configure Health Monitoring
- How to Add a Server to a Group
- How to View a Quick Summary of a Server's Health Status
- How to View Server Health Details
- How to Compare Server Health Details

For complete information on Health Monitoring Services, see the *Health Monitoring Services Administration Guide* (server_health.pdf).

You can access this guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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Novell HMS Components

Health Monitoring Services in Novell OES includes several components. The most significant are described in the following:

Table 3-17

Component	Description
CIM	Common Information Model (CIM) is a conceptual information model that enables management of heterogeneous networks using standard methods. There are two parts to CIM: The CIM specification and the CIM schema.
CIMOM	Common Information Model Object Manager (CIMOM) is a CIM object manager, or more specifically, an application that manages objects according to the WBEM standard. OES contains the CIMOM from the OpenWBEM project.
Providers	Providers plug in to the OpenWBEM to extend its functionality. Each provider instruments one or more aspects of the CIM Schema. Novell LIFE providers include some HMS providers and a base set of accompanying Novell schemas.
Monitor Servers link in iManager	Health Monitoring plug-in for iManager that provides an interface for monitoring server health.

Types of Health Monitoring

HMS provides the following monitoring types:

- **Robust health monitoring.** Robust health monitoring provides statistics for a system in the following categories:
  - Memory
  - Operating System
  - Processes/Threads
  - Network

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- CPU

  To use this type of health monitoring, the owcimomd module must be running on the servers being monitored so the status can be obtained.

  You must also be authenticated to the server being monitored in order to view health status, edit, or change the type of monitoring that you want to view.

- **Simple server status.** This type monitors only whether the server is up and running or down based on a connection attempt to at least one of the following standard ports:
  - 7 (Echo)
  - 13 (Time)
  - 20 (FTP)
  - 22 (SSH)
  - 23 (Telnet)
  - 80 (HTTP)
  - 135 (DCE endpoint resolution)
  - 443 (Secure HTTP)
  - 445 (Microsoft Directory Services)
  - 524 (NCPTM, eDirectory)

In this release, the ports searched for are not configurable.

If a firewall blocks all of these ports or if routing disables them, then obtaining a Simple Server status is not possible.

HMS is not cluster-enabled; if the server you are monitoring from fails, you must log in to Novell iManager again.

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Platform Compatibility

The following summarizes the compatibility of Health Monitoring Services with various network operating systems:

Table 3-18

Type	OS	Compatible Versions	Notes
Simple	Any	N/A	At least one of the specified ports must be open and not blocked by routing.
Robust	NetWare	OES on NetWare NetWare 6.5 SP3 or later	If you are upgrading from NetWare 6.5 SP2 to SP3 or later, you must have iManager 2.5 somewhere in your network and you must install OpenWBEM manually.
Robust	Linux	SUSE LINUX Enterprise Server 9 SP1 or later	None.

How to Access HMS

To access HMS, do the following:

1. Open and log in to iManager.

   If you log in to iManager as the Admin user or as a user with rights equivalent to Admin, you can perform all the available Health Monitoring Services tasks.

   If you log in to iManager as a user other than Admin, you must have sufficient rights to monitor servers. The HMS object must already be created and you must have the following rights to the HMS object:

   - [All Attributes Rights] Compare/Read/Write

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- [Entry Rights] Browse/Create/Rename/Delete

2. (Conditional) If it is not already selected, select the **Roles and Tasks** view.
3. From the left frame, select **Servers > Monitor Servers**.

   From here you can configure and display statistics for OES servers.

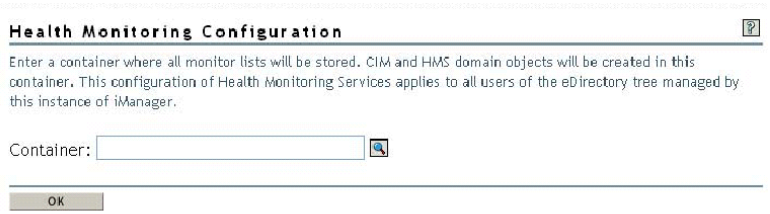
HMS uses anonymous SSL for the communication between iManager and the various OpenWBEM CIMOM agents that are being monitored.

Because of this, HMS should be used only within trusted networks (behind a firewall) where there is a low risk for man-in-the-middle attacks.

How to Configure Health Monitoring

The first time you select Monitor Servers to use Health Monitoring Services, no eDirectory objects for this service exist in the eDirectory tree. The following appears:

Figure 3-22



You are asked to specify a location for your monitoring list to be stored in.

Do the following:

1. In the Container field, do one of the following:
   - Type the full distinguished name of the ***container object*** where you want to maintain the list of servers or the name of the ***container*** where the CIM object already exists.

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or

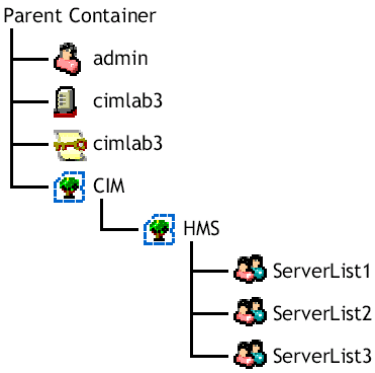
- Locate the container using the **Object Selector** icon and select it.

  Make sure that you select a container in the eDirectory tree that all users with responsibilities for managing health services have rights to access and make changes to.

2. When you finish, select **OK**.

CIM, HMS, and ServerList objects are created in your tree as shown in the following:

Figure 3-23



Objects that are in the same container as the CIM object vary depending on the parent container selected.

Each time you or another administrator uses a different server to monitor server health (another instance of iManager), you are asked to specify this location.

You can point to the same location (recommended) if you want to use the same server monitoring lists and you have sufficient rights.

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If you specify a different location, new objects are created in the alternate location and you must create new monitoring lists or import an existing server list.

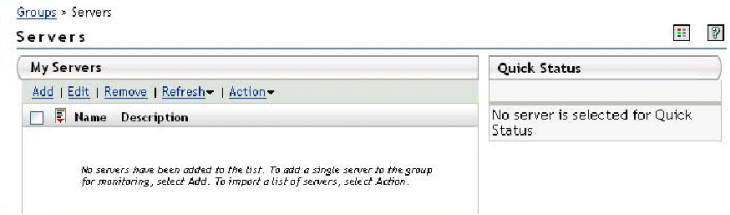
If you specify the same location where the CIM object already exists, the existing groups and server lists are displayed.

You can also change the location of the monitoring list objects in the eDirectory tree.

How to Add a Server to a Group

After specifying a location for the Health Monitoring System eDirectory objects, a default group (My Servers) appears:

Figure 3-24



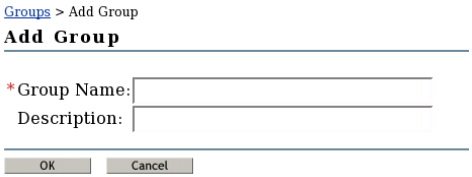
Before you can monitor servers, you must create a list of servers to monitor. You can add servers to the default group or create a new group and add servers to it.

To add a server to a group, do the following:

1. From the Servers page, select **Add**.

   The following appears:

Figure 3-25



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2. Enter the appropriate information in the following fields:
   - **Server Name.** Enter a name for the server you want to add. You might want to match the actual host name of the server.
   - **IP Address/DNS Name.** Enter the IP address or DNS name for the server you want to add.

     This information must match the actual IP address or DNS name for the server. If the address or name is not correct, the monitoring software cannot locate the server and return the health status.
   - **Description.** Type a description for the server you want to add.

     You might want to enter data about the version of the operating system or the type of software being run so you can quickly identify the different servers listed.
3. Select the type of monitoring you want performed on this server:
   - **Robust Health Monitoring.** This type monitors statistics in the following categories:
     - Memory
     - Operating System
     - Processes/Threads
     - Network
     - CPU

     The owcimomd module must be running on the servers being monitored so Robust data can be obtained.

     In this release of Health Monitoring Services,
     - Filtering which statistics are monitored is not configurable.
     - Configuring thresholds for monitored item on Linux is not configurable.

       For items monitored on NetWare, the defaults are set and can be changed through NRM.

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- **Simple Server Status.** This monitors only whether the server is up and running or down, based on a connection attempt to a specified port.

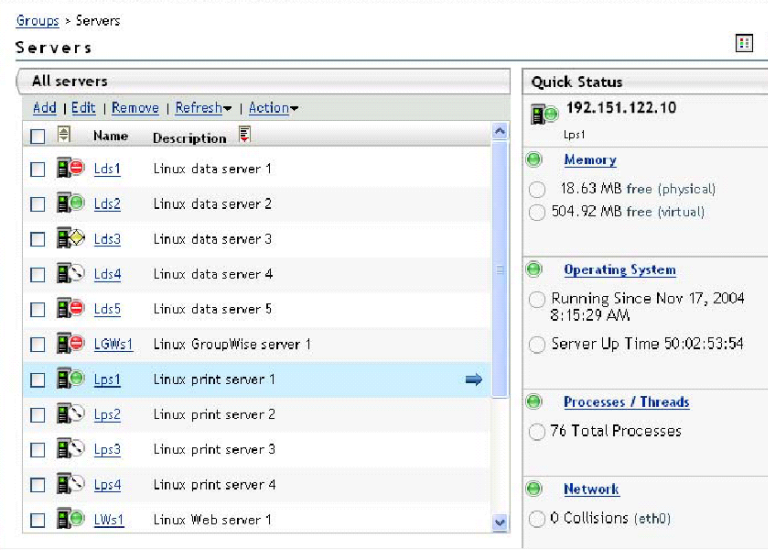
4. When you finish, select **OK**.

   You are returned to the Servers page.

How to View a Quick Summary of a Server's Health Status

To quickly view details about overall server status, select a server in the list of monitored servers by clicking the row for the server that you want to view. Information similar to the following appears:

Figure 3-26



The selected server row is shaded light blue and has an arrow pointing to the Quick Status panel.

The amount of detail shown depends on the monitoring type selected for the server and whether you are authenticated to the server.

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If a No Authentication icon is displayed for the server's health status, you are prompted to log in to the server before a quick status is displayed.

How to View Server Health Details

When you want to view the details of a server's health, you must be authenticated to the server.

1. Select the name link for the server you want to view.
2. (Conditional) If prompted, log in to the server.

   If a No Authentication icon is displayed for the server's health status, you are prompted to log in to the server.

   If the server is an OES Linux server in a network that has LUM installed and this service is enabled to use Linux User Management, you can log in as the Admin user or as a user with rights equivalent to user Admin.

   If the server is not enabled for LUM, you must log in as the Root user.

   If the server is an OES NetWare server, you must log in as the Admin user.

If you are not logged in as Admin, you must have rights to view the HMS object.

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For the Robust type of health monitoring, a page similar to the following appears:

Figure 3-27

3. Select one of the following links to view server health details:

Table 3-19

Link	Description of Details
Memory	Statistics about physical and virtual memory in the server being monitored.
Operating System	Details about the server such as operating system, including OS type, kernel version, total number of processes running, server up time, and load average.
Processes and Threads	An overview of the total number of processes in the system, the types of processes, and the number of processes in each state at each update interval.

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(continued) **Table 3-19**

Link	Description of Details
Network	Network Card Overall Status and Device Active statistics, and detailed statistics about LAN traffic, transmit and receive errors, or collisions for each network board.
CPU	The overall CPU status and the data for each CPU in the device being monitored. Some additional statistics do not show health, but do give information about each of the processors on the system.

4. (Optional) To get a description of the status and the actions recommended for each status, access the online help on each page.
5. When you finish, select **OK**.

If the server whose details you want to view is selected in the quick status view, you can also click the applicable link in the quick status view.

How to Compare Server Health Details

To compare the views of more than one server or look at several pages at the same time on one server, do the following:

1. Display the link of the view that you want to monitor.
2. Right-click the link.
3. Select **Open Link** in a new window or tab.
4. Resize and position the view to the desired size and location.

Repeat these steps for each view.

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Exercise 3-6 Check the Health of Your OES Servers

In this exercise, you use HMS to check the health of your Novell OES servers.

Exercise 3-6 Check the Health of Your OES Servers is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 3-32.

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Summary

Objective	Summary
1. Manage OES Servers Remotely with OpenSSH	Novell OES provides the package OpenSSH on both OES Linux and OES NetWare. To effectively use OpenSSH to remotely perform basic administrative tasks on OES servers, you need to know the following: ■ Benefits of OpenSSH ■ OpenSSH and OES Linux ■ OpenSSH and OES NetWare ■ How to Use SSH Commands
2. Manage OES Servers with Novell Remote Manager (NRM)	Novell Remote Manager (NRM) is a browser-based utility that you can use to manage one or more OES NetWare or OES Linux servers from a remote location. In this objective, you learned the following about NRM: ■ NRM in a mixed Novell OES Server environment ■ How to get started with NRM on OES NetWare ■ How to get started with NRM on OES Linux ■ How to configure groups and group operations

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Objective	Summary
3. Monitor eDirectory Trees on OES with Novell iMonitor	Novell iMonitor provides cross-platform monitoring and diagnostic capability to all servers in your eDirectory tree. The information you view in iMonitor immediately shows what is happening on your server. In this objective, we assumed that you already knew how to use iMonitor for NetWare servers, but needed to review the following information as it applies to OES Linux: ■ Novell OES iMonitor features ■ System requirements ■ How to access iMonitor ■ Novell Remote Manager integration

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Objective	Summary
4. Manage Novell OES Servers with Novell iManager	Novell iManager is a web-based administration console that provides secure, customized access to network administration utilities and content from virtually anywhere you have access to the Internet and a web browser. In this objective, you learned the following about Novell iManager 2.5 and running iManager from an OES Linux server desktop: ■ What's new in version 2.5 ■ How to access iManager ■ How to initially configure RBS ■ How to configure RBS roles ■ How to customize iManager ■ How to monitor server health ■ iManager issues in Novell OES

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SECTION 4 Implement DNS/DHCP on a Novell OES Linux Server

In this section, you learn how to configure DNS/DHCP on a Novell OES Linux server.

Objectives

1. Configure DNS on a Novell OES Linux
2. Configure a DHCP Server on a Novell OES Linux

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Introduction

OES Linux provides all the networking infrastructure services that you are already familiar with. In this section, you configure the DNS and DHCP services integrated into OES Linux and configured and managed through YaST.

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Objective 1 Configure DNS on a Novell OES Linux

Before configuring DNS on your OES Linux server, you need to understand the following:

- How DNS Is Implemented on OES Linux
- How to Configure DNS on OES Linux with YaST
- What the DNS Server Configuration Files Are
- How to Test DNS on OES Linux

How DNS Is Implemented on OES Linux

Domain Name Services (DNS) is the standard name resolution service in TCP/IP-based networks.

DNS is based on the BIND (Berkeley Internet name domain) architecture developed for UNIX systems. It is often paired with Dynamic Host Configuration Protocol (DHCP) to provide host server configuration information to clients.

Novell has developed a directory-enabled DNS/DHCP service for NetWare that complies with the BIND 9.2 standard. Novell DNS/DHCP Services leverage eDirectory to provide centralized configuration and management of the services.

Administrators can manage Novell DNS/DHCP Services using the Web-based iManager utility or the standalone DNS/DHCP Management Console.

OES Linux also uses a BIND-compliant DNS Server.

Because the DNS/DHCP services for OES NetWare and OES Linux both adhere to the BIND standard, they can coexist on the same network. Clients can receive name resolution and host configuration information from any DNS/DHCP server that is available.

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Some DNS security mechanisms, such as DNS Security Transaction Signatures and DNS Security Extensions, are not supported in the OES NetWare DNS server.

The OES Linux DNS server does not support the dynamic reconfiguration and SNMP Traps that are available with the OES NetWare DNS server. It is not integrated with eDirectory and cannot be managed with iManager or the Novell DNS/DHCP Management Console.

For details on DNS on OES Linux, see “DNS - Domain Name Service” on page 310 of the *SUSE Linux Enterprise Server 9 Administration Guide* (sles_admin.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

For details on DNS on OES NetWare, see “Configure DNS” on page 71 of the *Novell DNS/DHCP Services Administration Guide for NetWare* (dhcp_enu.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

How to Configure DNS on OES Linux with YaST

The process for configuring a DNS server on OES Linux is accomplished through the YaST utility.

To begin the process, launch YaST and select **Network Services > DNS Server**. If the bind packages are not installed yet, you will be prompted to install them and to insert the CD that contains the installation files.

The first time you access the DNS server through YaST, a DNS server installation process is performed. In this process you configure certain DNS server settings, which are written to the /etc/named.conf file.

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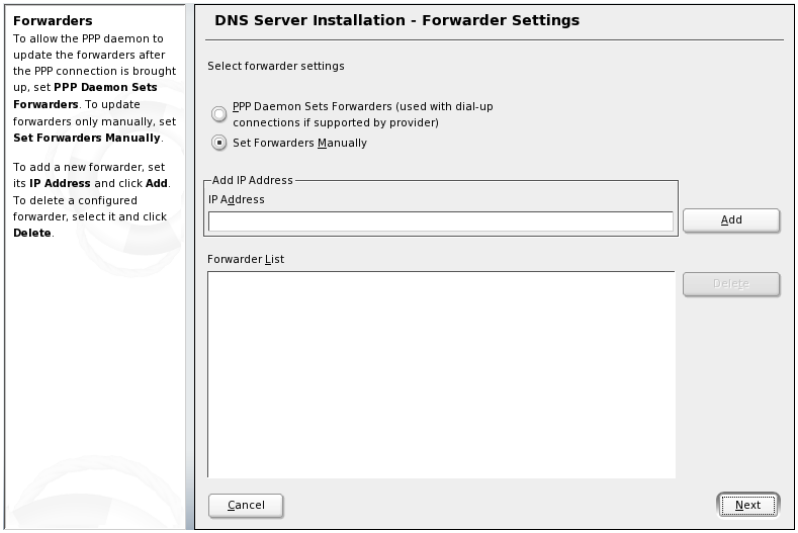
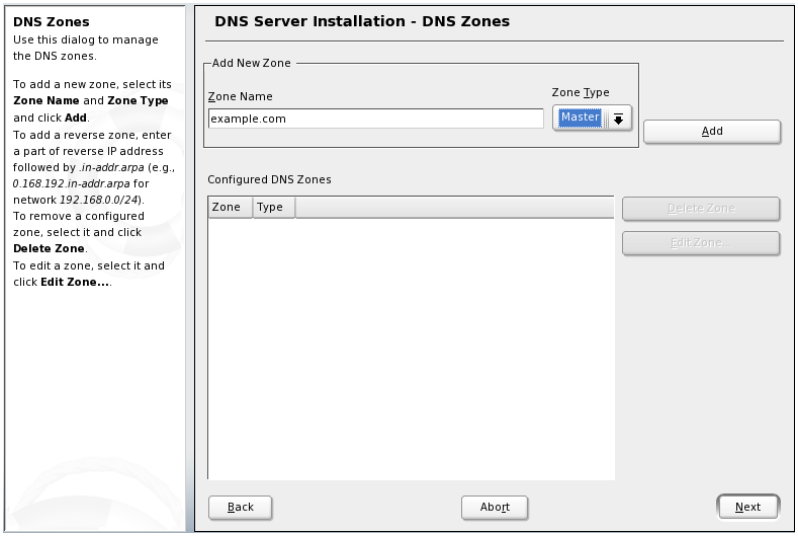
After installation of the required packages, a Forwarder Settings page for your DNS server appears:

Figure 4-1



After you have configured the Forwarder Settings, a second page lets you define the DNS Zones:

Figure 4-2



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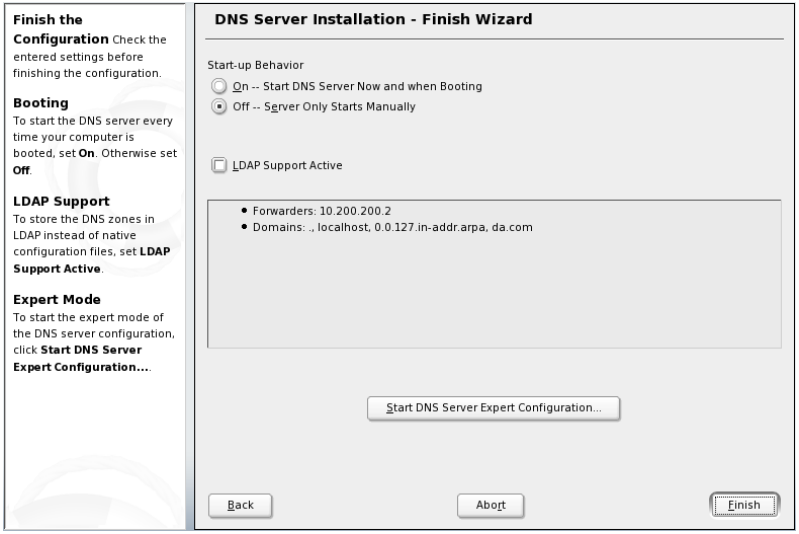
A final page lets you configure start-up behavior and LDAP support and start expert configuration:

Figure 4-3



When you select Finish from this page, services are stopped, configuration information is written to files, and services are restarted. You are then returned to the YaST Control Center.

Once the DNS server is configured, accessing the DNS server configuration from YaST again displays an interface from which you can configure DNS zones, start-up behavior, logging, and other options.

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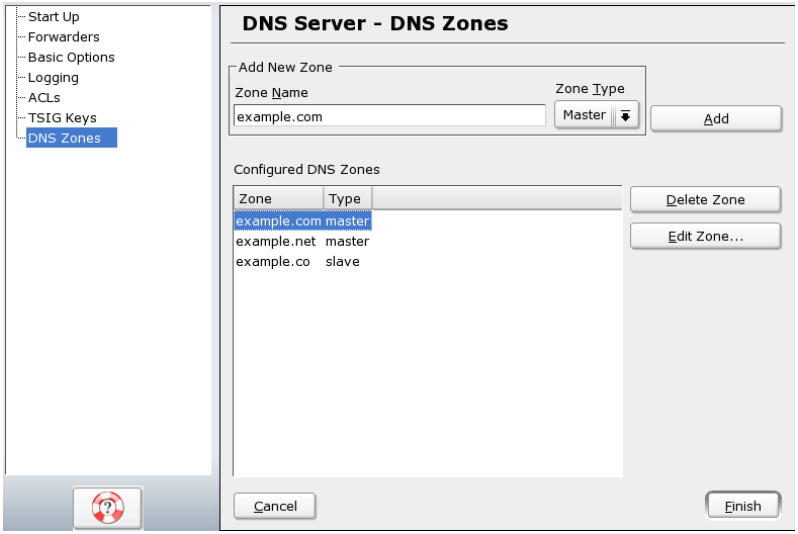
For example, if you select the DNS Zones option, the following appears:

Figure 4-4



All the configuration options available from this page are listed on the left.

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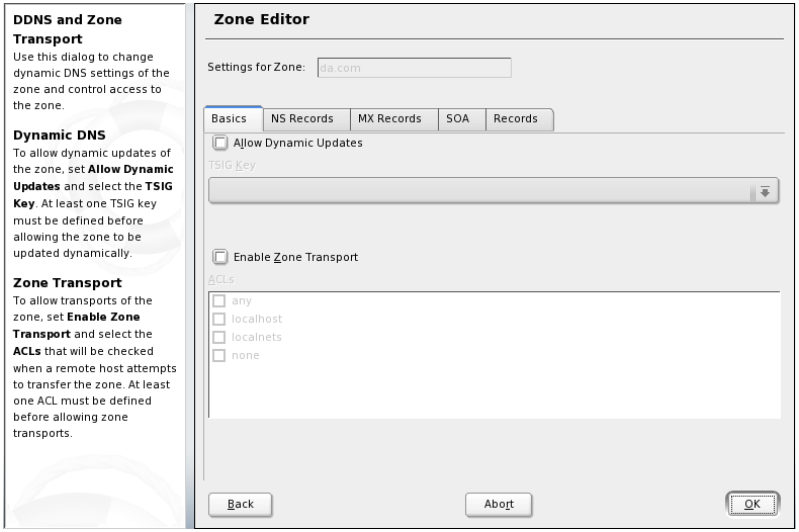
From the page shown in Figure 4-4 you can create, edit, and delete zones. When you edit a zone, YaST launches a Zone Editor, as shown in the following (with the NS Records tab selected):

Figure 4-5



When you are done editing zone settings and entering records for each zone, you select **OK** to leave the Zone Editor page.

You are returned to the main DNS Server page shown in Figure 4-4. From the main DNS Server page, you select **Finish**. YaST stops services, writes configuration information, and then restarts services.

What the DNS Server Configuration Files Are

YaST and the automated configuration it does for you make it a convenient tool. However, you still need to be familiar with the following files that control and configure the DNS service:

- /etc/named.conf
- /var/lib/named/

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/etc/named.conf

The file that configures the basic behavior of your DNS server is /etc/named.conf. At its most basic, this file contains two sections:

- **Options**. The options section of named.conf contains the settings connected with the configuration choices shown in Figures 4-1 and 4-3.

  The options you can configure in this section do the following:

  - Indicate the directory where the zone configuration files are to be saved, such as the default location; /var/lib/named/.
  - Apply to the behavior of the DNS service.
  - Allow you to enter global directives that apply to all the zones hosted by the server.

- **Zone Declarations**. The zone declarations portion of the named.conf file are used to create zones for the DNS server to host. These declarations contain the following:

  - Zone name.
  - Zone type.
  - File name where specific zone configuration data is kept. The location of this file is assumed to be the directory indicated in the options section.

  Installing the DNS service creates three zones by default:

  - **localhost.** A master zone that resolves 127.0.0.1.
  - **0.0.127.in-addr.arpa.** A master reverse-lookup zone for localhost.
  - **Hint zone.** A zone which is indicated with a period (“.”).

  Any other zones you create in YaST are defined in the zone declarations portion of the named.conf file. You can also edit this file manually, if you are comfortable with the requirements and syntax.

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For details on /etc/named.conf, see “The Configuration File /etc/named.conf” on page 311 of the *SUSE Linux Enterprise Server 9 Administration Guide* (sles_admin.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

If you edit this file manually, your changes do not take effect until the DNS service is restarted. To restart the service, enter the following:

- **/etc/init.d/named restart**

  or

- **rcnamed restart**

/var/lib/named/

By default the DNS service on OES Linux is configured to place zone configuration files in /var/lib/named. This directory location is indicated in the options section of /etc/named.conf.

The zone configuration files for the three default zones are found in this directory. They are named as follows:

- localhost.zone
- 127.0.0.zone
- root.hint

If you created a da.com zone in YaST, it would write the configuration information for da.com in /var/lib/named/da.zone.

The information found in a .zone file includes a TTL (time to live) setting, SOA data, and any records (NS, MX, A, CNAME) you enter for the zone.

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For details on zone files, see “Structure of Zone Files” on page 314 of the *SUSE Linux Enterprise Server 9 Administration Guide* (sles_admin.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

How to Test DNS on OES Linux

After you start the name service daemon, named, you should verify that the name server is running and resolving DNS names and IP addresses correctly.

You can use the following commands on an OES Linux server:

- **nslookup**. The nslookup command works the same on OES Linux as it does on NetWare. The difference is that the nslookup command has been deprecated on Linux. nslookup is being replace by the *dig* command.
- **dig**. The dig command functions in much the same way as nslookup. The basic syntax for dig is

  dig *dns_name*

  For example, to make sure that da1.da.com is being resolved to the correct IP address, enter the following:

  dig da1.da.com

  Unlike nslookup, dig cannot be used to verify reverse lookup resolution. Instead, the *host* command is available for that purpose.
- **host**. The host command allows you to verify that the in-addr.arpa zone on your name server is configured correctly. The basic syntax for host is

  host *IP_address*

  For example, to test that 10.200.200.1 is being resolved to the correct DNS name, enter the following:

  host 10.200.200.1

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Exercise 4-1 Configure DNS on the DA1 Linux Server with YaST

You currently have a DNS service running on your DA2 NetWare server. However, you would like to move the DNS service from DA2 and provide the DNS service from the DA1 Linux server.

In this exercise, you use YaST to configure and start a DNS server on your OES Linux server, and then shut down the DNS service on the DA2 NetWare server.

Exercise 4-1 Configure DNS on the DA1 Linux Server with YaST is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 4-2.

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Objective 2 Configure a DHCP Server on a Novell OES Linux

Both a DHCP server and DHCP clients are available for OES Linux. The DHCP service is dhcpd (published by the Internet Software Consortium, the same source for named).

The core of any DHCP system is the dynamic host configuration protocol daemon. This services leases addresses and watches how they are used, according to the settings defined in the configuration file /etc/dhcpd.conf.

By changing the parameters and values in this file, you can influence the program's behavior in numerous ways.

In OES Linux, you can configure the DHCP service in YaST or you can manually edit the necessary configuration files.

To use DHCP on OES Linux, you need to know the following:

- How to Configure DHCP on OES Linux with YaST
- Understand the DHCP Configuration File

For additional details on configuring DHCP on OES Linux, see “DHCP” on page 353 of the *SUSE Linux Enterprise Server 9 Administration Guide* (sles_admin.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

How to Configure DHCP on OES Linux with YaST

To configure a DHCP server, launch **YaST** and select **Network Services > DHCP Server**.

If the DHCP package is not installed, you are prompted to install it by inserting the Novell OES CD that has the package files.

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The first time you access DHCP Server through YaST, a DHCP setup wizard is launched. The setup wizard gathers basic information for the /etc/dhcpd.conf file.

The first page in the wizard asks you to identify the ethernet card attached to the subnet your DHCP server will service.

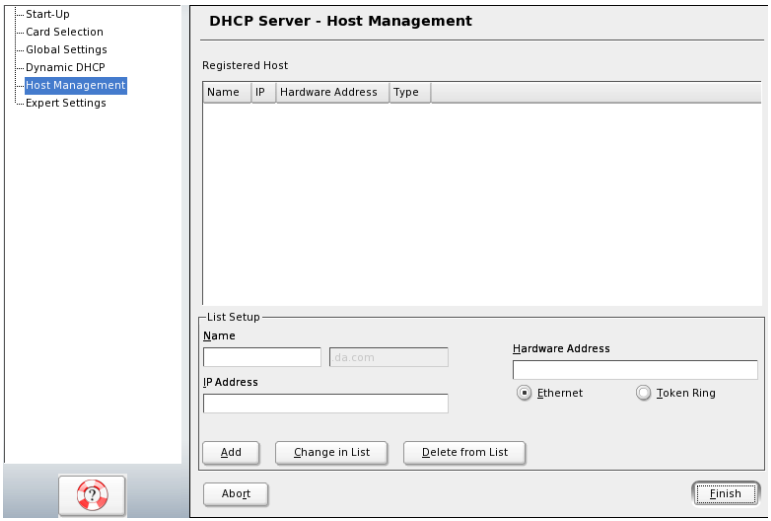
The second page in the wizard asks you to configure global settings, such as the IP address for the DNS server and the IP address for the router.

The third page in the wizard asks you to enter a range of IP addresses available to be leased to network hosts. You cannot do advanced subnet configuration in the wizard.

When you select OK to leave the third page, the main DHCP server configuration page appears. Similar to the DNS Server main configuration page, you are given several configuration categories to choose from on the left side of the page.

The following shows this page, with the Host Management category selected:

Figure 4-6



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When you are done with the configuration category, you select another category. When you are done, you select **Finish**. The DHCP service is stopped, configuration information is written to configuration files, and the service is restarted.

Understand the DHCP Configuration File

The file that controls and configures the way your DHCP service behaves is /etc/dhcpd.conf. Any DHCP configurations you create in YaST are written to this file. The following is an example of a basic dhcpd.conf file:

Figure 4-7

```
default-lease-time 600;          # 10 minutes
max-lease-time 7200;             # 2  hours

option domain-name "kosmos.all";
option domain-name-servers 192.168.1.1, 192.168.1.2;
option broadcast-address 192.168.1.255;
option routers 192.168.1.254;
option subnet-mask 255.255.255.0;

subnet 192.168.1.0 netmask 255.255.255.0
 {
  range 192.168.1.10 192.168.1.20;
  range 192.168.1.100 192.168.1.200;
 }
```

The entries in this file indicate lease time behavior, optional information that can be sent (such as a domain name and IP address and mask) to a host to configure its IP settings, and the subnet with its range of available addresses.

If you configure this file manually, the changes will not take effect until you restart the DHCP daemon by entering the one of the following:

- **/etc/init.d/dhcpd restart**

  or

- **rcdhcpd restart**

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Exercise 4-2 Configure DHCP on the DA1 Linux Server with YaST

Besides running DNS from your DA1 Linux server, you would also like to run a DHCP server. Currently, you have DHCP running on the DA2 NetWare server.

In this exercise, you use YaST to configure and start a DHCP server on your OES Linux server, and then shut down the DHCP service on the DA2 NetWare server.

Exercise 4-2 Configure DHCP on the DA1 Linux Server with YaST is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 4-13.

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Summary

Objective	Summary
1. Configure DNS on a Novell OES Linux	In this objective you learned that before configuring DNS on your OES Linux server, you need to understand the following: ■ How DNS Is Implemented on OES Linux ■ How to Configure DNS on OES Linux with YaST ■ What the DNS Server Configuration Files Are ■ How to Test DNS on OES Linux
2. Configure a DHCP Server on a Novell OES Linux	In this objective you learned that a DHCP server and DHCP clients are available for OES Linux. The DHCP service is dhcpd (published by the Internet Software Consortium, the same source for named). In OES Linux, you can configure the DHCP service in YaST or you can manually edit the necessary configuration files. To use DHCP on OES Linux, you need to know the following: ■ How to Configure DHCP on OES Linux with YaST ■ Understand the DHCP Configuration File

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SECTION 5 Migrate NSS Volumes to an OES Linux Server

In this section, you learn how to migrate NSS volumes from a NetWare server to an OES Linux server for data access through the Novell Client.

Objectives

1. Configure Time Synchronization on Novell OES
2. Configure eDirectory with ndsconfig
3. Configure eDirectory Users to Access an OES Linux Server
4. Describe Novell OES Storage Solutions
5. Provide File Access with NCP Server
6. Configure Novell Storage Services
7. Migrate NSS Volumes Using the Server Consolidation Utility

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Introduction

Novell Open Enterprise Services (OES) provides several file storage options that can be implemented on both Novell OES NetWare and Novell OES Linux platforms.

This section discusses the process of migrating NSS volumes from a NetWare server to an OES Linux server. Before performing this process you should understand the following:

- NSS Migration (NetWare to OES Linux) Requirements
- The NSS Migration Scenario

NSS Migration (NetWare to OES Linux) Requirements

Several requirements must be met before beginning an NSS migration. This section discusses what those requirements are and the role they play in a successful migration.

NSS migration requirements include the presence of and correct configuration of the following:

- Time Synchronization
- Linux User Management (LUM)
- NCP Server

This section also discusses storage solutions in Open Enterprise Server in general (for NetWare and Linux) and basic NSS concepts specifically.

The NSS Migration Scenario

The NSS migration exercises associated with this section are based on a scenario where a network administrator wants to move user data (on NSS volumes) from NetWare to Linux without users needing to know or do anything about it.

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For example, after users leave the office on Friday, the NSS volumes are migrated to an OES Linux server over the weekend. When users come back to the office on Monday, they log in as usual and see the same directories and files they always see; however, now their directories and files are hosted by a Linux server.

After meeting the NSS migration requirements, the process consists of using

- The Server Consolidation Utility for the migration
- Modifying login scripts

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Objective 1 Configure Time Synchronization on Novell OES

In this objective you learn how to use Network Time Protocol (NTP) to maintain a common time for all the servers in your network.

In Exercise 5-1 Migrate the DA1 Linux Server to the DA-CORP Tree on page 5-2 of your *Integrating Novell Open Enterprise Server Workbook* you configure the DA2 NetWare server to use the DA1 Linux server as a time provider.

The DA1 Linux server uses the Network Time Protocol (NTP), so you should be able to do the following:

- Identify Network Time Protocol Basics
- Configure NTP on Your Network

Identify Network Time Protocol Basics

As the eDirectory environment continues to expand to include mixed operating system environments, time synchronization is becoming more dependent on NTP.

To understand NTP, you need to understand the following:

- What NTP Is
- Stratum
- ntpdate
- xntpd
- ntptrace

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What NTP Is

This objective is designed to teach you some of the basic concepts and programs included in the NTP distribution. It is not designed to teach you everything about NTP. For more information on NTP, visit www.ntp.org.

NTP is an industry standard protocol that uses User Datagram Protocol (UDP) on port 123 to communicate between time providers and time consumers.

The UDP protocol suite is part of the TCP/IP protocol suite. Therefore, a computer using NTP needs the TCP/IP protocol suite loaded.

An NTP time provider is a server that understands the NTP protocol and provides NTP time to other servers or to workstations on the network. The NTP time provider gives time to operating systems that are NTP-compliant.

An NTP time consumer is a server that understands the NTP protocol and seeks NTP time from an NTP time provider. A time consumer can, in turn, act as a time provider for other servers and client workstations on the network.

The NTP time consumer can work with operating systems that are NTP-compliant.

Any computers on your network with Internet access can get time from NTP servers on the Internet. NTP synchronizes clocks to the Universal Time Coordinated (UTC) standard, which is the international time standard.

NTP not only corrects the time, but it keeps track of consistent time variations and automatically adjusts for time drift on the client. It allows for less network traffic and it keeps the client clocks more stable, even when the network is down.

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Stratum

NTP introduces the concept of a stratum. Stratum ***x*** is used as a designation of the location of the servers in NTP tree hierarchy.

Stratum-1 is the first (highest) level in the hierarchy. It denotes servers that adjust their time by means of some external reference time source (such as a GPS, an atomic clock, or radio).

Servers that synchronize their time to stratum 1 servers are denoted as stratum 2, and those that use stratum 2 servers to synchronize their time are denoted as stratum 3, and so on until you reach a stratum level of 15 (the maximum allowed).

The higher the stratum number, the lower it is in the stratum hierarchy and the less preference it has in relation to other servers with a lower number.

For example, a stratum 3 server (one that is using a stratum 2 server as a time provider) takes precedence over a stratum 10 server (such as one that is using its local clock default settings). The stratum 10 server is lower in the stratum hierarchy than the stratum 3 server.

Differences between stratum-2 and stratum-1 servers are normally very small and, for the majority of users, unnoticeable.

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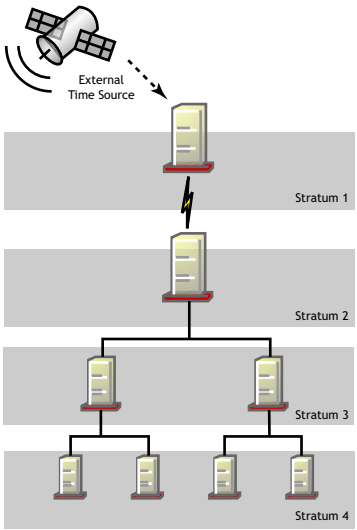
The following figure depicts the stratum hierarchy.

Figure 5-1



Generally only one server in a network communicates with an external time provider. This reduces network traffic across geographical locations and minimizes traffic across routers and WANs.

ntpdate

The NTP distribution includes the ntpdate program which can be used for a fast one-time synchronization between a time provider and a time consumer.

To perform a one-time update of the client to the server, enter the following at the console prompt:

ntpdate ***ip_address_of_time_provider***

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Because the ntpdate synchronization only occurs once, the time consumer's clock will eventually stray from the time on the time provider's clock. Therefore, ntpdate is not the best long-term solution for time synchronization.

xntpd

The NTP distribution includes xntpd, the NTP daemon. This daemon is used by both the time provider (server) and the time consumer (client) to give and to obtain time respectively.

The xntpd process is designed to adjust time continuously, making the time adjustments very small.

xntpd can also limit the wander of the local clock based on historical data, even when a time provider is unavailable.

The xntpd process requires little resource overhead. This allows NTP to be easily deployed on servers hosting other services, even if the servers are heavily loaded.

How xntpd Works

Each time the NTP daemon is started, it reads the /etc/ntp.conf file on the host computer. This file is the NTP configuration file. It tells the NTP daemon which time providers to use.

The default configuration uses the following two lines to declare itself a time provider with a stratum level of 10 and to use its own internal clock as its time source:

server 127.127.1.0
fudge 127.127.1.0 stratum 10

To configure the daemon to use a time provider other than its own clock, add the following line to the ntp.conf file:

server *IP_address_of_time_provider*

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Because of the algorithm that the NTP daemon uses, it is best to synchronize with multiple servers to help protect the client from an incorrect or downed server. In many environments, it is unlikely that an NTP server failure will be noticed quickly.

To synchronize with multiple servers, simply add several lines like the following to the ntp.conf file:

server *IP_address1*

server *IP_address2*

server *IP_address3*

You can leave the default lines that declare the server as a time provider with a stratum level of 10 alone. These lines provide you with a backup in case the servers you are using become inaccessible.

If any changes are made to the ntp.conf file, the daemon will need to be stopped and restarted in order to update the configuration without rebooting. The xntpd process can be started or restarted at any time.

To start xntpd, when logged in as root, enter **rcxntpd start**.

To stop xntpd, when logged in as root, enter **rcxntpd stop**.

To restart xntpd, when logged in as root, enter **rcxntpd restart**.

After the ntp.conf file has been read by xntpd, the client sends a request to the server and the server sends back a time stamped response, along with information such as its accuracy and stratum.

Transactions between the client and the server occur about once per minute, decreasing gradually to once per 17 minutes under normal conditions. Poorly synchronized clients will tend to poll more often than well-synchronized clients.

The client uses the information it gets from the server or servers to calibrate its clock. This consists of the client determining how far its clock is off and adjusting its time to match that of the server.

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To allow clocks to quickly achieve high accuracy, yet avoid overshooting the time with large time adjustments, NTP uses a system where large adjustments occur quickly and small adjustments occur over time.

For small time differences (less than 128 milliseconds), NTP uses a gradual adjustment. This is called *slewing*. For larger time differences, the adjustment is immediate. This is called *stepping*.

If the inaccuracy of a clock becomes too great (off by more than about 17 minutes), NTP aborts the NTP daemon, with the assumption that something has gone wrong with either the client or the server. This is referred to as an *insane* time source.

Because NTP averages the results of several time exchanges to reduce the effects of variable latency, it may take several minutes for NTP to reach consensus on what the average latency is.

For these reasons, it often takes several adjustments (and several minutes) for NTP to reach synchronization.

In the long run, NTP tries to decrease the amount of polling it does by making the clock on each system become more accurate.

For a complete list of the files and programs included in the NTP distribution, visit http://www.ntp.org.

ntptrace

The NTP distribution also includes the ntptrace program. ntptrace is an informational tool that traces the source of time that a time consumer is receiving. It can be a useful debugging tool.

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The following is an example of ntptrace output:

```
localhost: stratum 3, offset 0.000723, synch distance
1.18225
tick.east.ca: stratum 2, offset 1.601143, synch
distance 0.06713
tock.usask.ca: stratum 1, offset 1.712003, synch
distance 0.00723, refid 'TRUE'
```

The ntptrace output lists the client name, its stratum, its time offset from the local host, the synchronization distance, and the ID of the reference clock attached to a server (if one exists).

The synchronization distance is a measure of clock accuracy, assuming that it has a correct time source.

Configure NTP on Your Network

The following are ways to configure NTP on your network:

- Use a Public NTP Time Server
- Use a Reference Clock
- Use a Server's Local Clock
- Use an NTP Time Source in Your Network

Use a Public NTP Time Server

For most small organizations (fewer than 100 servers), synchronizing your servers to accurate public NTP servers is the most commonly used method for time synchronization.

Because stratum-1 servers are generally closed to public access, stratum-2 servers should be used. Your network, however, should be designed to minimize the number of servers that interact with the public NTP servers.

A good strategy is to have one or two of your servers synchronize with NTP stratum-2 time servers, and then have those servers provide time for the rest of your servers.

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For a list of publicly available NTP stratum-2 time servers, visit http://ntp.isc.org/bin/view/Servers/WebHome.

To configure a server to obtain time from a particular NTP time server, do the following:

1. If NTP is not installed already, install it.

   NTP can be obtained from online sources or from the *Linux Installation CD*.

2. Open the /etc/ntp.conf file using a Linux text editor.

3. Add a line similar to the following for each NTP server that you want to use as a time provider:

   server *IP_address_of_time_provider*

4. Save the file and exit the editor.

5. Start the NTP daemon by entering **rcxntpd start**.

   The daemon will attempt to get an initial date and time from the NTP server you configured and will return a “done” or a “failed” message.

6. Configure the xntpd daemon to automatically start when the server boots by entering **chkconfig xntpd 235** at a command prompt.

Use a Reference Clock

You can use your own reference clock to provide time for your network. Reference clocks are devices that synchronize to the correct time using a variety of technologies, including long wave radio signals, GPS transmissions, or CDMA technology.

True reference clocks can be expensive to obtain and maintain, but several devices are cheaper and still provide time within a few milliseconds of UTC.

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Several factors need to be taken into account when choosing a reference clock. GPS receivers, for example, need to be mounted in a window or on the roof and some radio receivers may have problems operating in a shielded room.

Also, to prepare for clock failure or to prevent an incorrect clock from affecting your time consumers, it is best to have at least three different reference clocks for fault tolerance.

You can find information on how to choose reference clocks at http://www.ntp.org.

Use a Server's Local Clock

You can use your server's internal local clock as a time source. Because a local clock's time can wander, this is generally not a preferred time synchronization solution.

The ntp.conf file is preconfigured to use the server's local clock as the time source, so it does not need to be edited. The NTP daemon, however, does need to be started.

To configure a server to obtain time from its own local clock, do the following:

1. If NTP is not installed already, install it.

   NTP can be obtained from online sources or from the *Linux Installation CD*.

2. At the server console, start the NTP daemon by entering **rcxntpd start**.

3. Configure the xntpd daemon to start automatically when the server boots by entering **chkconfig xntpd 235** at a command prompt.

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Use an NTP Time Source in Your Network

In this course, DA1 is already set up as an NTP time provider. To set up your SUSE Linux server to get time from DA1, you need to follow these general steps:

1. Log in to your SUSE Linux server as root so you have rights to edit the ntp.conf file.
2. From a terminal session, use ntpdate to do a one-time time synchronization operation. This is shown in the following:

Figure 5-2

```
DA1:~ # ntpdate 10.200.200.2
 4 Jul 03:30:10 ntpdate[8452]: step time server 10.200.200.2 offset 5.842241 sec
DA1:~ # ntpdate 10.200.200.2
 4 Jul 03:30:14 ntpdate[8453]: adjust time server 10.200.200.2 offset -0.005370
DA1:~ #
```

You might need to enter the command twice to get the offset amount down to about 0, as shown in Figure 5-2. (The offset is shown in milliseconds.)

3. To configure the /etc/ntp.conf to use your designated server as the time provider, you simply add the following command to the file:

   server *IP address*

   This is illustrated in the following below the "##server xx.xx.xx.xx" line:

Figure 5-3

```
##
server 127.127.1.0              # local clock (LCL)
fudge  127.127.1.0 stratum 10   # LCL is unsynchronized

##
## Outside source of synchronized time
##
server 10.200.200.2             # IP address of server

##
## Miscellaneous stuff
##

driftfile /var/lib/ntp/drift/ntp.drift # path for drift file

logfile   /var/log/ntp          # alternate log file
# logconfig =syncstatus + sysevents
# logconfig =all
```


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4. After the /etc/ntp.conf file is modified and saved, you start the service with following:

   rcxntpd start

   Or, if the NTP daemon is already running, you restart the service by entering the following:

   rcxntpd restart

   You can then verify that your server's time is synchronized with the time provider by entering

   ntpq -p

   The results of both of these commands are shown in the following:

Figure 5-4

```
DA1:~ # ntpq -p
     remote           refid      st t when poll reach   delay   offset  jitter
==============================================================================
 LOCAL(0)        LOCAL(0)        10 l    8   64    1    0.000    0.000   0.008
 da2.da.com      LOCAL(0)         4 u    7   64    1    0.872   71.076   0.008
```

The offset between this server and the NTP time provider (10.200.200.2) is shown in milliseconds and is well below the 2-second threshold that eDirectory allows.

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Objective 2 Configure eDirectory with ndsconfig

In this course, you move an OES Linux server from its own eDirectory tree in to an existing eDirectory tree with a NetWare server.

You can accomplish much of this by using the eDirectory YaST module. However, for consistent reliability, Novell recommends that you use the ndsconfig utility to either install the server into an existing tree.

You must be logged in as root to use ndsconfig. When ndsconfig is used with arguments, it validates all arguments and prompts for the username and password of an eDirectory user with administrative rights to the tree.

Using ndsconfig, you can

- Create a Tree
- Add a Server into an Existing Tree
- Remove a Server from the Tree

ndsconfig uses the following syntax:

ndsconfig ***type*** [**-m** ***modulename***] [**-S** ***servername***] [**-t** ***tree_name***] [**-n** ***context***] [**-d** ***path_for_DIB***] [**-L** ***ldap_port***] [**-l** ***ssl_port***] [**-e**] **-a** ***admin_name***

You can use the following parameters:

Table 5-1

Parameter	Use
Type	
■ new	■ Creates a new eDirectory tree.
■ def	■ Creates a new eDirectory tree.
■ add	■ Adds a server into a tree.
■ rm	■ Removes a server from a tree.
-S	Specifies the server name.

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(continued) **Table 5-1**

Parameter	Use
-t	Specifies the tree name to which the server will be added.
-n	Specifies the context into which the server object is added.
-d	Specifies the directory path where the database files will be stored.
-L	Specifies the TCP port number on the LDAP server.
-l	Specifies the SSL port number on the LDAP server.
-a	Specifies the distinguished name of the User object that has supervisor rights to the context in which the server object will be created.
-e	Enables clear text password for LDAP objects.
-p	Installs the eDirectory server into an existing tree by specifying the IP address of a server hosting the tree. If this option is used, SLP is not used for tree lookup.
-m	Specifies the module name to install. While installing a new tree, you can install only the ds module. After installing the ds module, you can add the LDAP and SAS services using the add command. If the module name is not specified, all 3 modules are installed.
-o	Specifies the HTTP clear port number.
-O	Specifies the HTTP secure port number.

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(continued) **Table 5-1**

Parameter	Use
set	Sets the value for the specified eDirectory configurable parameters. If the parameter list is not specified, ndsconfig lists all the eDirectory configurable parameters.
get	Lets you view the current value of the eDirectory configurable parameters.
get help	Lets you view the help strings for the eDirectory configurable parameters.

Create a Tree

To create a new tree and install the Linux server in it, use the following syntax:

ndsconfig new [**-m** ***modulename***] [**-i**] [**-S** ***servername***] [**-t** ***tree_name***] [**-n** ***context***] [**-d** ***path_for_DIB***] [**-L** ***ldap_port***] [**-l** ***ssl_port***] [**-e**] **-a** ***admin_name***

A new tree is installed with the specified tree name and context. If the parameters are not specified in the command line, ndsconfig prompts you to enter values for each of the missing parameters.

For example, to create a new tree named DIGITALAIR-TREE, to install the server in the O=DigitalAir context, and to create Admin in the O=DigitalAir context, enter the following command:

ndsconfig new -t DIGITALAIR-TREE -n O=DigitalAir -a CN=admin.O=DigitalAir

If SLP has not been configured or if the Linux server is having trouble contacting a server in the tree, use the **-p** parameter to specify the IP address of a server in the tree. Alternatively, you can use the /etc/hosts.nds file to specify the IP address of a server in the tree.

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The /etc/hosts.nds file is checked before the server attempts to use SLP to locate the tree. This file does not exist by default—it must be created manually. To learn more about using this file, enter the following at the console prompt:

man hosts.nds

If entering **man hosts.nds** does not give you a man page, check your /etc/manpath.config file to make sure that /usr/man is included in the MANDATORY_MANPATH.

Add a Server into an Existing Tree

To use ndsconfig to install the Linux server into an existing eDirectory tree, use the following syntax:

ndsconfig add [**-m** ***modulename***] [**-S** ***servername***] [**-p** ***IP_address***] [**-t** ***tree_name***] [**-n** ***context***] [**-d** ***path_for_DIB***] [**-L** ***ldap_port***] [**-l** ***ssl_port***] [**-e**] **-a** ***admin_name***

A server is added to an existing tree in the specified context. If the context does not exist, ndsconfig creates the context and adds the server.

For example, to add a server into an existing tree named DIGITALAIR-TREE in the SLC.DigitalAir context, enter the following command:

ndsconfig add -t DIGITALAIR-TREE -n OU=SLC.O=DigitalAir -a CN=admin.O=DigitalAir

Remove a Server from the Tree

You can also use ndsconfig to remove the server from the tree. To do this, use the following syntax:

ndsconfig rm -a ***admin_name***

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Objective 3 Configure eDirectory Users to Access an OES Linux Server

Just as users and groups on NetWare servers are managed through eDirectory, users and groups on Linux servers are managed according to the POSIX (Portable Operating System Interface) standard.

Because Novell OES provides services running on both Linux and NetWare, Novell has developed a technology that lets eDirectory users also function as POSIX users on Linux servers.

This technology is called Linux User Management or LUM.

To configure eDirectory users to access an OES Linux server through LUM, you need to know the following:

- LUM Fundamentals
- How to Implement LUM
- How to Enable eDirectory Users for Linux Access

For complete information on Linux User Management, see the *Novell OES Linux User Management Technology Guide* (lumadgd.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

LUM Fundamentals

The following helps you understand when LUM is required so that your network services are accessible and work as expected:

- LUM Overview
- How LUM Services Control Access
- Local or Remote Users
- OES Linux Services that Require LUM-Enabled Access

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- Services that Have Some LUM Requirements
- LUM Access Is Not Global Access to OES Linux

LUM Overview

Users in a Linux environment are defined and managed according to the POSIX (Portable Operating System Interface uniX) standard.

POSIX dictates that all users of a particular Linux server have standard attributes, such as user name, user ID (UID), primary group ID (GID), and password.

Novell Linux User Management (LUM) lets you use eDirectory to centrally manage remote users for access to one or more OES Linux servers.

In other words, LUM lets eDirectory users function as local (POSIX) users on an OES Linux server.

Access is enabled by leveraging the Linux Pluggable Authentication Module (PAM) architecture. PAM makes it possible for eDirectory users to authenticate with the OES Linux server through LDAP.

In OES, the terms *LUM-enabling* and *Linux-enabling* are both used to describe the process that adds standard Linux (POSIX) attributes and values to eDirectory users and groups, enabling them to function as POSIX users and groups on the server.

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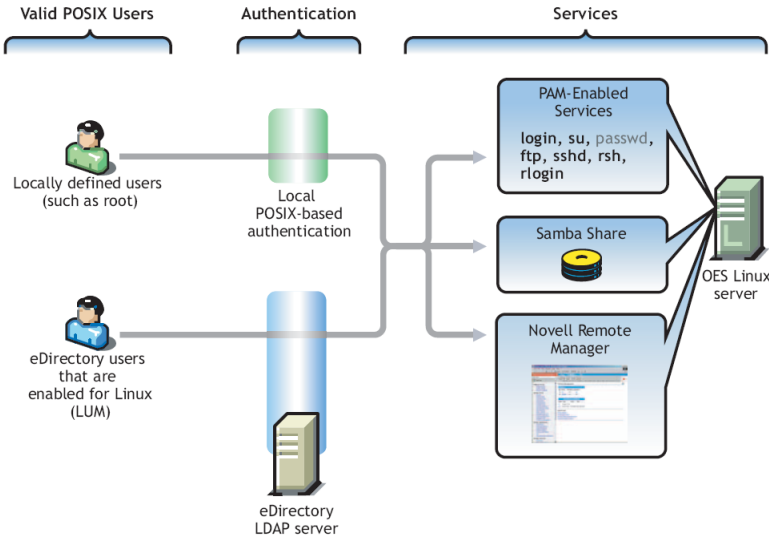
How LUM Services Control Access

The following illustrates how the LUM services in OES control access to the OES server:

Figure 5-5



The following describes the illustrated authentication process:

- **Valid POSIX users.** Some services on OES Linux servers must be accessed by POSIX users.

  eDirectory users can function as POSIX users if they are enabled for Linux access.

- **Authentication.** When the system receives an action request, it can authenticate both local POSIX users and users who have been enabled for Linux access.

- **Services.** Users can potentially access PAM-enabled services, Samba shares, and Novell Remote Manager as either local or eDirectory users.

  The passwd command is not enabled for eDirectory access because eDirectory passwords are maintained in eDirectory, not on the local server.

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Linux requires that all users be defined using standard POSIX attributes, such as user name, user ID (UID), primary group ID (GID), password, and other similar attributes.

Local or Remote Users

Users that access a Linux server can be created

- **Locally (on the server).** Local users are managed at a shell prompt using commands such as useradd) (see the useradd(8) man page) or YaST. These local users are stored in the /etc/passwd file (see the passwd(5) man page).

  or

- **Remotely (off the server).** Remote users can be managed by other systems, such as LDAP-compliant directory services.

  Remote user access is enabled through the PAM architecture on Linux.

Linux POSIX-compliant interfaces can authenticate both kinds of users, independent of where they are stored and how they are managed.

OES Linux Services that Require LUM-Enabled Access

Some services on an OES Linux server require that eDirectory users be Linux enabled to access the services. These include the following:

- **Core Linux utilities enabled for LUM.** These are the core utilities and other shell commands that you have specified during the OES installation to be enabled for authentication through eDirectory LDAP.

  In Linux these are known as PAM-enabled utilities.

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The following lists the core utilities available for LUM enablement:

Table 5-2

Command	Where Executed	Task
ftp	Another host	Transfer files to and from the OES server which, in this case, is a remote host.
login	■ OES server ■ SSH session with OES server	Log in to the OES server, either directly or in an SSH session with the server.
passwd	■ OES server ■ SSH session with OES server	Change the POSIX password.
rlogin	Another host	Log in to the OES server which, in this case, is a remote host.
rsh	Another host	Execute a command on the OES server which, in this case, is a remote host.
sshd	Another host	Establish a secure encrypted connection with the OES server which, in this case, is a remote host.
su	■ OES server ■ SSH session with OES server	Temporarily become another user. This is most often used to temporarily become the root user, who is not a LUM user and is, therefore, not affected by LUM.

- **Novell Samba (SMB/CIFS) shares on the server.** Windows workgroup users who need access to Samba shares defined on the server must also be Linux-enabled eDirectory users who are configured to access the server because Samba requires POSIX identification for access.

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By extension, NetStorage users who need access to SMB/CIFS Storage Location Objects that point to the server, must also be LUM-enabled eDirectory users with access to the server.

- **Novell Remote Manager (NRM) on Linux.** You can access NRM as
  - The root user with rights to see everything on the Linux server.
  - A local Linux user with access governed by POSIX access rights.
  - A LUM-enabled eDirectory user, such as the Admin user created during the installation.

Services that Have Some LUM Requirements

Services that do not require eDirectory users to be Linux enabled for service access but do have some LUM requirements, include the following:

- **QuickFinder, Novell iFolder 2.1*x*, and other Web services.** If only local users access these Web services, Linux enabling doesn't apply because the users are not remote eDirectory users.
- **NCP server.** The NCP server that has been ported to Linux remains tightly integrated with eDirectory and does not require eDirectory users to be Linux enabled.

  However, when NCP volumes are created that point to partitions other than NSS on the server, not all features are available if the user is not Linux enabled.

  For example, cross-protocol access is not possible if the user is not Linux enabled.
- **NSS.** eDirectory users that access NSS volumes directly using NCP (the Novell Client) are not required to be Linux enabled.

  However, if any other file access protocol is used to access NSS through the virtual file system layer that makes NSS appear to be a POSIX-compliant file system, the users must be LUM enabled.

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Although the above services do not require Linux-enabled access, the services themselves run as POSIX-compliant system users who function on behalf of the end users that are accessing the service.

If the services must access NSS volumes, the system users must be Linux enabled because only eDirectory users can access NSS volumes.

LUM Access Is Not Global Access to OES Linux

As you plan to Linux-enable users for access to these services, keep in mind that each OES Linux server that Linux-enabled users need to access must be associated with a Linux-enabled group that the users belong to.

In other words, it is not sufficient to Linux-enable users for access to a single OES Linux server if they need access to multiple servers.

An association between the Linux-enabled group that the users belong to and the eDirectory UNIX Workstation object associated with the server must be configured using iManager for each server to which users need access.

How to Implement LUM

The following are suggestions for implementing LUM in your OES network:

- Which Users to LUM Enable
- Enabling eDirectory Users for Linux Access
- Enabling Users to Access Multiple OES Linux Servers

Which Users to LUM Enable

When you install LUM on an OES Linux server, the Admin user object that installs LUM is automatically enabled for eDirectory LDAP authentication to the server.

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Beyond this, you need to identify the users (and groups) who need eDirectory LDAP access to OES Linux servers. You can determine this by doing the following:

1. Review the information in the table under “OES Linux Services that Require LUM-Enabled Access” on 5-23.
2. Identify the servers that will run the services mentioned.
3. Note the users and groups that you need to enable and the servers you need to enable them to access.

Enabling eDirectory Users for Linux Access

You can enable eDirectory users for LUM using either iManager 2.5 or the nambulkadd command:

- **iManager.** You can enable existing eDirectory users for Linux access using the LUM tasks in iManager.

  You can enable multiple users in the same operation as long as they can be assigned to the same primary Linux-enabled group. The process lets you associate the group with one or more OES Linux servers or Linux workstations.

- **nambulkadd.** If you have eDirectory users and groups that need to be enabled for Linux access, you can use the nambulkadd command to modify multiple objects simultaneously.

When using iManager to manage OES Linux access, you might notice a discrepancy in naming.

When OES Linux servers are created, a **UNIX Workstation - *server_name*** object is created in eDirectory, where ***server_name*** is the DNS name of the OES Linux server.

The iManager Linux User Management plug-in refers to these server objects as “Linux Workstation” objects. Both “UNIX Workstation” and “Linux Workstation” refer to the same eDirectory objects.

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Enabling Users to Access Multiple OES Linux Servers

You can enable users for access to multiple OES Linux servers by associating the Linux-enabled group to which users belong with each UNIX Workstation (Linux Workstation) object you want users to have access to.

Users gain server access through their Linux-enabled group assignment rather than through a direct assignment to the UNIX Workstation (Linux Workstation) objects themselves.

How to Enable eDirectory Users for Linux Access

The following provide steps for Linux-enabling eDirectory users:

- How to Enable eDirectory Groups for Linux Access
- How to Enable eDirectory Users for Linux Access

You can only enable users for LUM on OES Linux servers with LUM installed.

How to Enable eDirectory Groups for Linux Access

The following steps assume that the eDirectory Group objects already exist and that any user objects you want to enable for Linux also exist and have been assigned to the groups.

To enable eDirectory groups for Linux access, do the following:

1. Log in to iManager as the eDirectory **admin** user or equivalent.
2. Select **Linux User Management > Enable Groups for Linux**.
3. Browse to and select one or more ***group objects***; then select **OK**.
4. (Conditional) If you want all users assigned to the group to be enabled for Linux, make sure the **Linux-Enable All Users in These Groups** option is selected.

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5. Select **Next** twice.
6. Browse to and select one or more **UNIX Workstation** (OES Linux server) objects; then select **OK**.
7. Select **Next**; then select **Finish**.
8. Select **OK**.

How to Enable eDirectory Users for Linux Access

The following steps assume that the eDirectory user objects already exist.

To enable eDirectory users for Linux access, do the following:

1. Log in to iManager as the eDirectory **admin** user or equivalent.
2. Select **Linux User Management > Enable Users for Linux**.
3. Browse to and select one or more ***user objects***; then select **OK**.
4. Select **Next**.
5. Do one of the following:
   - Select and enable an existing eDirectory group for Linux.
   - Select an eDirectory group that is already enabled for Linux.

     or
   - Specify the name and context of a new eDirectory group to create and enable for Linux.
6. When you finish, select **Next**.
7. Browse to and select one or more **UNIX Workstation** (OES Linux server) objects; then select **OK**.
8. Select **Next**; then select **Finish**.
9. Select **OK**.

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Exercise 5-1 Migrate the DA1 Linux Server to the DA-CORP Tree

Now that you have reviewed time synchronization and Linux user management, you are ready to begin Exercise 5-1.

Currently, the DA2 NetWare and DA1 Linux servers are in separate trees: DA2 NetWare is in the DA-CORP tree and DA1 Linux is in the DA-SERVICES tree. Each server is using its own local clock as a time provider.

The exercise begins with steps to configure the DA2 NetWare server to use the DA1 Linux server as a time provider so that the two servers will be time synchronized.

Because the DA1 Linux server is currently hosting the DA-SERVICES eDirectory tree, you must remove the server from this tree before installing DA1 Linux into the DA-CORP tree.

Because the DA1 Linux server is also currently hosting a LUM configuration that works with the DA-SERVICES tree, part of the exercise involves removing the current LUM configuration and then reconfiguring LUM to work with the DA-CORP tree.

Exercise 5-1 Migrate the DA1 Linux Server to the DA-CORP Tree is in your *Integrating Novell Open Enterprise Server Workbook for Linux* on page 5-2.

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Objective 4 Describe Novell OES Storage Solutions

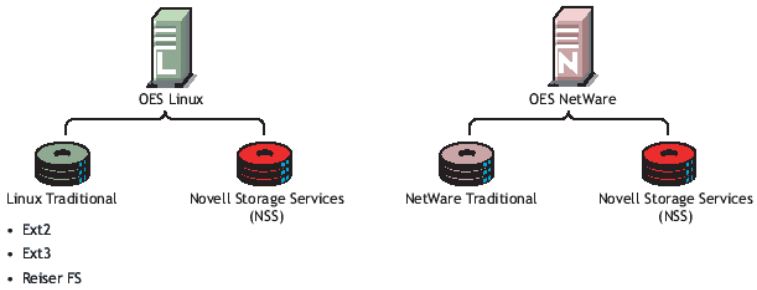
To describe the storage solutions available in Novell OES, you need to understand the following:

- File System Support in Novell OES
- NetWare Core Protocol Support (Novell Client Support) on Linux
- Storage Options
- OES File Storage Planning

File System Support in Novell OES

As illustrated in the following, both Novell OES server platforms support Novell® Storage Services™ (NSS) and their traditional file systems:

Figure 5-6



The following provides a summary of the file system types:

- **Traditional Linux file systems.** Novell OES Linux (SLES 9) supports a number of different file systems, the most common of which are ext2, ext3, and ReiserFS.

  There are no differences in support for OES services on the various Linux traditional file systems.

  There are differences in service support between Linux Traditional and Novell Storage Services (NSS) on OES Linux.

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- **Traditional NetWare File System.** Although it is considered a legacy file system on NetWare servers, the NetWare traditional file system is still robust and powerful, and it supports the NetWare file service access model.
- **Novell Storage Services (NSS).** NSS lets you manage your shared file storage for any size organization.

  On NetWare, NSS features include:

  - Visibility
  - Trustee access control model
  - Multiple simultaneous namespace support
  - Native Unicode
  - User and directory quotas
  - Rich file attributes
  - Multiple data stream support
  - Event file lists
  - File salvage subsystem

  Many of these features are also supported on NSS in OES Linux.

For a comparison of NSS on NetWare and Linux, see "Comparison of NSS on NetWare and NSS on Linux" on page 413 of the *Novell Storage Services File System Administration Guide* (nss_enu.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

NetWare Core Protocol Support (Novell Client Support) on Linux

Many organizations rely on NetWare Core Protocol™ (NCP™) and the Novell Client™ software for highly secure access to file storage services.

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The NCP server for OES Linux lets you attach to Linux using Novell Client software.

Storage Options

To understand Novell OES storage options, you need to know about the following:

- Direct-Attached Storage Options (NSS and Traditional)
- Advanced Storage Options (NSS Only)

Direct-Attached Storage Options (NSS and Traditional)

As shown in Figure 5-6, you can install traditional volumes and Novell Storage System (NSS) volumes on both Novell OES platforms.

These devices can be installed within the server or attached directly to the server through an external SCSI bus.

Advanced Storage Options (NSS Only)

NSS volumes support the following advanced storage solutions:

- **Network Attached Storage (NAS) solutions.** A NAS is a dedicated data server or appliance that provides centralized storage access for users and application servers through the existing network infrastructure. It uses traditional LAN protocols such as Ethernet and TCP/IP.

  When Gigabit Ethernet is used, access speeds are similar to directly attached storage device speeds.

  The downside is that data requests and data compete for network bandwidth.

- **Storage Area Network (SAN) solutions.** A SAN is a separate, dedicated data network consisting of servers and storage media that are connected through high-speed interconnects.

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- **Novell iSCSI.** You can create a SAN using Novell iSCSI, which uses Novell eDirectory to manage iSCSI resources, including granting trustee rights and user file access.
- **Fault tolerant and high-availability architectures.** You can use one or more of the following technologies:
  - **Multiple Path I/O.** NSS helps prevent failure in the connection between the CPU and the storage device by automatically identifying multiple paths between each NetWare server and its storage devices.
  - **Software RAIDs.** NSS supports software RAIDS to improve storage availability and performance by enhancing data fault tolerance and I/O performance.
  - **Server Clusters.** You can configure OES NetWare or OES Linux servers in a high-availability cluster that uses a shared storage device.

    In a cluster, resources and services are configured to automatically switch from one server to another if the hosting server fails.

    You can also manually switch services from one server to another to help you maintain and upgrade servers during production hours and eliminate scheduled downtime.

OES File Storage Planning

The following helps you plan for storage on your OES network:

- File Service Support Considerations
- NSS Planning Considerations

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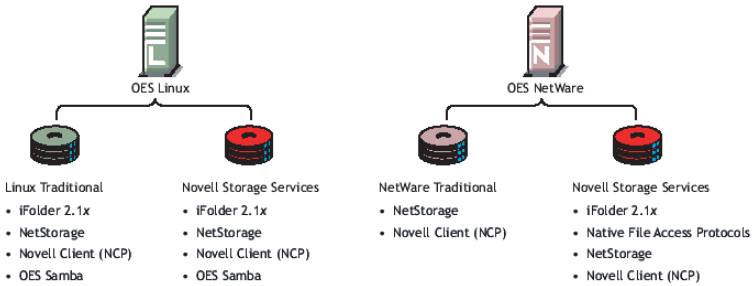
File Service Support Considerations

The following illustrates which file services can access which volume types in Novell OES:

Figure 5-7



NSS Planning Considerations

The following are NSS planning considerations:

- **Device size limit.** NSS recognizes logical or physical devices up to 2 terabytes (TB) in size. If you have a storage disk larger than 2 TB, use the storage device's management utility to partition the disk into smaller logical devices to use with the NSS file system.

  This is especially important to remember when planning for NSS volumes on OES Linux because the size limit for Linux traditional volumes is 8 terabytes.

- **Other NSS planning topics.** When planning for NSS volumes, take the following topics into consideration:
  - Prerequisite system requirements
  - Security considerations
  - Planning for future storage needs
  - Creating and naming storage objects in eDirectory

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For details on storage planning, see “Planning for NSS Storage Solutions” on page 65 of the *Novell Storage Services File System Administration Guide* (nss_enu.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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Objective 5 Provide File Access with NCP Server

Novell Client for Windows is the long-standing software solution for providing NCP-based access to NetWare data from Windows workstations.

The Novell Client extends the capabilities of Windows desktops to access the full range of Novell services, such as authentication to eDirectory, network browsing and service resolution, and secure file system access.

It supports traditional Novell protocols such as NCP, RSA, and NDAP, and it interoperates with open protocols such as LDAP.

The Novell Client for Linux provides these same services for Linux workstations. Novell Client for Linux is expected to become available as a no-cost download soon after the release of OES.

Because NCP is now available on OES Linux, Novell Client users can attach to OES Linux servers as easily as they have been able to attach to NetWare servers.

The NCP Server for Linux enables support for login script, drive mapping to OES Linux servers, and other services commonly associated with Novell Client access.

In this objective, you learn the following about the NCP services included in Novell OES:

- Purpose of NCP
- How to Install and Configure NetWare NCP Server
- How to Install and Configure Linux NCP Server

Transaction Tracking and Opportunistic Locking are not supported in the initial release of Novell OES.

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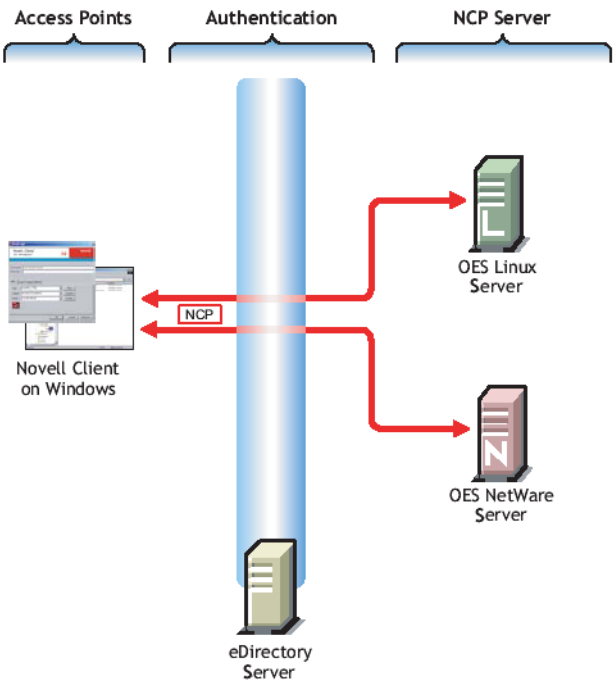
Purpose of NCP

With Novell OES, the NetWare Core Protocol (NCP) supports many of the network services on OES NetWare and OES Linux servers.

Windows users can use the Novell Client to access data, manage files and folders, and map drives on OES Linux servers the same way they do on NetWare servers.

The following illustrates the basics of NCP file services:

Figure 5-8



How to Install and Configure NetWare NCP Server

After installing an OES NetWare server, eDirectory users on workstations with the Novell Client can access all the directories and files to which you have granted them access.

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With NCP volumes on OES NetWare, rights can be managed either through NRM or from the Novell Client.

You use the Novell Client to manage file system rights by doing the following:

1. Use the Novell Client to log in to the tree as a ***user*** with Supervisor rights to the NCP volume.
2. Navigate to the NCP volume (using My Network Places, for example) and locate the folder you want to manage rights for.
3. Right-click the ***folder*** and select **Properties**; then select the **NetWare Rights** tab.
4. Browse to and select the ***user*** you want to give trustee rights to; then select **Add**.
5. From the Trustee list at the top of the Properties window, select the ***boxes*** for the desired file system rights; then select **OK**.

How to Install and Configure Linux NCP Server

When you install OES Linux, NCP Server is selected by default. NSS can be installed with NCP Server, but is not required.

If you have installed the NCP Server for Linux, the same eDirectory/Novell Client users can access files on the OES Linux server. However, there are no home or data volumes available initially.

These require a setup step not required on OES NetWare.

To configure NCP on OES Linux, you need to know the following:

- The Default NCP Volume
- How to Create Volume Pointers
- How to Assign File Trustee Rights

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The Default NCP Volume

The NCP Server for Linux enables NCP access to NCP volumes defined on the OES Linux server.

When you install the NCP server, the installation creates one NCP volume named SYS that maps to the /usr/novell/sys folder on the Linux server.

This NCP volume contains LOGIN and PUBLIC directories that, in turn, contain a small subset of the files found on a NetWare server in the directories with the same names.

How to Create Volume Pointers

Initially, there are no NCP home directories or data volumes available to Novell Clients that attach to an OES Linux server.

If you want users to have NCP home or data directories on the server, you must decide where you want these directories to appear in the server's directory structure and then create NCP volumes using the NCPCON utility at the Linux shell prompt.

For example, if you want to create an NCP volume (pointer) named HOME, you would perform the following steps:

1. Determine that you want to mount it at the /home mount point on the Linux server.

   Different from other mount points on a Linux system, you can mount an NCP volume at a populated directory. The files and directories below this mount point are simply being made accessible to NCP clients.

2. Create the volume pointer:

   a. At the terminal prompt, enter **ncpcon**.

   b. At the ncpcon prompt, enter **create volume HOME /home**.

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After the volume pointer is created, a Novell Client can attach to the OES Linux server and see the HOME volume along with the SYS volume created by the installation.

NCP Volume pointers are always created with uppercase names (HOME, SYS, etc.) regardless of the case specified when the volume pointers are created.

How to Assign File Trustee Rights

You use the Novell Client for creating file system trustees for NCP volumes on OES Linux servers the same way you do for NCP volumes on OES NetWare.

However, Novell Remote Manager on OES Linux cannot be used for creating file system trustees or managing rights on an NCP volume.

The trustee assignments for an NCP volume on OES Linux are stored in the .trustee_database.xml file for that volume. This XML file is stored in the folder that is used as the NCP volume mount point.

The dot at the beginning of the file name indicates that this is a hidden file.

For example, for the HOME volume mounted at /home, trustee assignments are kept in the /home/.trustee_database.xml file.An example of a .trustee_database.xml file, with no trustee assignments configured is shown in the following:

Figure 5-9

```
<volume_trustees>
  <inherited_rights_mask path="/.trustee_work.dat">
    <rights>S</rights>
  </inherited_rights_mask>
  <inherited_rights_mask path="/.trustee_database.xml">
    <rights>S</rights>
  </inherited_rights_mask>
</volume_trustees>
```


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After a few trustee assignments have been made, the .trustee_database.xml file looks similar to the following:

Figure 5-10

```
<volume_trustees>
  <trustee path="/RLaJoie">
    <name>RLaJoie.IS.SLC.DA</name>
    <rights>RWCEMF</rights>
  </trustee>
  <trustee path="/KKeetch">
    <name>KKeetch.IS.LSC.DA</name>
    <rights>RWCEMF</rights>
  </trustee>
  <inherited_rights_mask path="/.trustee_work.dat">
    <rights>S</rights>
  </inherited_rights_mask>
  <inherited_rights_mask path="/.trustee_database.xml">
    <rights>S</rights>
  </inherited_rights_mask>
</volume_trustees>
```

The trustee assignments are defined within the <trustee> element, using the <name> and <rights> elements. The <trustee> element uses the path="/*path_name*" parameter to specify the directory on the NCP volume that this trustee assignment applies to.

The initial slash (/) in the path name represents the root of the NCP volume. If the HOME volume is mounted at /home, the path name in the first trustee assignment shown in Figure 5-10 ("/RLaJoie"), is referring to the /home/RLaJoie directory.

The recommended method for adding trustee assignments to the .trustee_database.xml file is to do it indirectly, through the Novell Client. The Novell Client does not make any typographical errors and it ensures that the new trustee assignment is immediately effective.

In the absence of a Novell Client, you can edit the .trustee_database.xml file directly using vim. It is a read-only file so any changes you make can only be saved by using the **:w!** switch to force the changes to be saved.

After saving the changes, you have to make the changes take effect by using the ncpcon console to dismount and mount the volume.

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For example, if you made changes for the HOME volume, you would enter the following in ncpcon:

dismount HOME
mount HOME

If you have to manually edit the .trustee_database.xml file, be careful not to make any typing errors.

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Objective 6 Configure Novell Storage Services

Before you install and configure Novell Storage Service (NSS) on your OES Linux or OES NetWare server, make sure you are familiar with the following:

- What NSS Is
- NSS Benefits
- NSS Pools and Volumes
- Comparison of NSS on NetWare and NSS on Linux
- NSS and EVMS on OES Linux
- How to Install NSS on an OES Linux Server
- How to Use the NSSMU Management Utility in OES Linux
- How to Assign File System Rights for NSS Volumes on OES Linux

What NSS Is

Novell OES provides Novell Storage Services™ (NSS) File System for both Linux and NetWare® kernels. Its many features and capabilities include

- Visibility
- Trustee access control model
- Multiple simultaneous name space support
- Native Unicode
- User and directory quotas
- Rich file attributes
- Multiple data stream support
- Event file lists
- A file salvage subsystem

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These features can help you effectively manage your shared file storage for any size organization, scaling management of the system for even organizations with hundreds of thousands of employees.

NSS volumes are cross compatible between kernels. You can mount an NSS data volume on either kernel—Linux or NetWare—and move it between them.

In a clustered SAN with Novell Cluster Services, volumes can fail over between kernels, allowing for full data and file system feature preservation when migrating data to Linux.

You can manage all storage management functions in the Web-based Novell iManager utility. NSS also supports third-party tools on both kernels for advanced data protection and management, virus scanning, and traditional archive and backup solutions.

NSS Benefits

Files are at the heart of every company, large or small. You cannot afford unreliable file service, especially when the files you manage are continually growing and requiring more and more storage space.

In addition, your business requirements today demand more storage space and faster and easier access to data. To meet the demands, you need a file system that can scale to a growing business, is easily maintained, and is better protected against corruption.

NSS provides the following benefits on Linux and NetWare for a robust and reliable file system solution:

- A journaling file system that lets you create bigger volumes that activate (mount) quicker, store more data, and resist corruption better than non-journaling file systems
- Encrypted volume support to meet the legal standard of making data inaccessible to software that circumvents normal access control, such as if the media were stolen
- An unlimited number of NSS volumes

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- Software RAID 0 (striping), RAID 1 (mirroring), RAID 5 (striping), RAID 10 (mirroring RAID 0 devices), and RAID 15 (mirroring RAID 5 devices)
- Multiple server activation prevention (MSAP) to help protect pools from being concurrently activated by multiple servers that do not share a cluster relationship
- An NSS volume in a pool of storage that spans multiple storage devices
- Up to 4 billion (10E9) files in a single directory
- Faster access to data, regardless of file size or volume size
- Lower memory requirements: 1 MB of RAM can activate an NSS volume
- Directory space restrictions
- User space restrictions
- Salvage support for deleted volumes and files

NSS provides the following additional benefits on NetWare:

- Multiple I/O path support
- Pool snapshots that capture point-in-time versions of files in the pool
- Transaction Tracking System™ (TTS™)
- Mountable media and image files activated as NSS volumes
- Novell Distributed File Services (NDFS) that let you move and split volumes to better manage storage growth
- Novell Archive and Version Services that let you archive interval-based versions of user files and make them available to users for individual retrieval

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For details, see the *Novell Archive and Version Services 2.0 for NetWare Administration Guide* (arc_admin.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

NSS Pools and Volumes

NSS is a 64-bit file system that can manage a virtually unlimited number of file objects. On each physical storage device, NSS abstracts up to four physical NetWare partitions to make them appear as contiguous free space.

To understand how physical storage space is managed by NSS, you need to know about

- NSS Storage Pools
- NSS Volumes

NSS Storage Pools

NSS recognizes physical and logical devices up to 2 TB in size. You can create any number of virtual storage resources, called *pools*, on these devices.

You can choose space from at least four logical devices of up to 2 TB each to create a pool with a maximum pool size of 8 TB. A pool can contain any number of volumes, depending on the pool size where the minimum volume size is 10 MB.

If the pool spans devices by using space from them for the pool, the volumes automatically span the devices. A single volume can contain up to 8 trillion files and grow to 8 TB in size, depending on the size of the pool and space consumed by other volumes in the pool.

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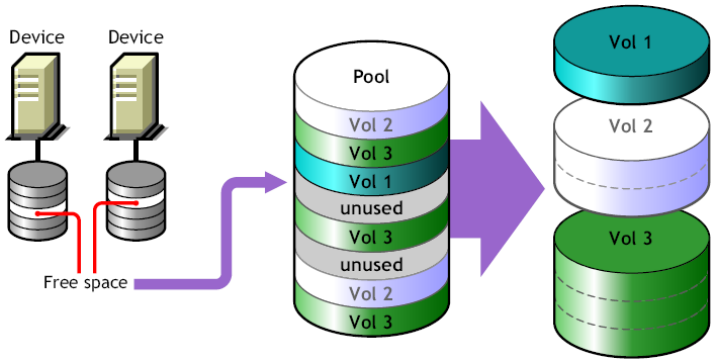
You can create additional storage pools by assigning areas of free space obtained from one or more of a server's storage devices. You can create one or more NSS volumes from the space in the storage pool.

The following illustrates how NSS uses free space on multiple devices to create a storage pool:

Figure 5-11



During the NetWare installation, NSS automatically creates a system pool (sys) and an NSS volume (sys:) that can grow to the size of the pool.

We recommend that you reserve the system pool and volume for operating system software and extensions. Create additional pools to effectively store applications, files, and databases.

NSS Volumes

The logical volumes you create on NSS storage pools are called *NSS volumes*.

You can specify a maximum storage quota for the volume, or allow the volume to grow dynamically to the size of its pool. You can add any number of volumes to a storage pool.

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Because there is no limit to the number of volumes you can create, it is possible that the combined administrative size of all the volumes taken together is larger than the physical size of the storage pool itself. NSS refers to this process as “overbooking.”

If you overbook space in the pool, the individual administrative size of a volume cannot exceed the size of the storage pool.

NSS allocates space from the pools to the volumes only as needed. Typically, user consumption of a volume’s available space ebbs and flows; it is unlikely that users concurrently consume volumes at 100% of their available capacity. Each volume consumes the space it needs as it needs it.

By overbooking space, NSS provides a flexible and cost-effective way to accommodate expanding storage needs.

For example, suppose you have a 300 GB storage pool. From this storage pool, you create two NSS volumes of 200 GB.

You can define two 200 GB NSS volumes out of a storage pool of only 300 GB, if you feel comfortable that the NSS volumes will not both exceed 75 percent capacity (150 GB) and, therefore, exceed the overall size of the storage pool.

If one NSS volume does reach 150 GB, but the other volume stays under 100 GB, your overbooking plan worked.

Suppose you expect that one of the volumes might exceed its share of the pool. You can overbook the pool by creating one NSS volume with a quota of 200 GB and a second NSS volume that can grow to the size of the pool.

As the combined size nears the size of the pool, you can extend the size of the pool to allow more space for the larger, expanding volume.

Your overbooking plan works because you built in the opportunity to expand the pool and volume, according to your business needs.

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Comparison of NSS on NetWare and NSS on Linux

The following compares features and capabilities of NSS on the NetWare and Linux platforms for OES:

Table 5-3

Feature Description	Platform Capabilities
Management interfaces	**NetWare and Linux** ■ Novell iManager ■ NSSMU ■ Novell NetStorage **NetWare** ■ Server console utilities (nssmu, rights, flag) ■ Novell Remote Manager (primarily for trustee management, file and directory purge and salvage) ■ ConsoleOne® (DFS junctions, VLDB, and file system trustees and trustee rights) **Linux** ■ EVMS (evmsgui) ■ Novell Remote Manager (browse only) ■ Server console utilities (nssmu, rights, nsscon, attrib, ravsui, ravview)
File system trustees and trustee rights to control access to directories and files	**NetWare and Linux** ■ Novell NetStorage (via Web browser only, not WebDAV) ■ Novell Client™ ■ Rights utility **NetWare** ■ Novell Remote Manager ■ ConsoleOne

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(continued) **Table 5-3**

Feature Description	Platform Capabilities
File system directory and file attributes to control functions available for directories and files	**NetWare and Linux** ■ Novell NetStorage ■ Novell Client (NCP™) ■ Rights Utility ■ Novell Remote Manager **NetWare** ■ ConsoleOne
Directory quotas management	**NetWare and Linux** ■ Novell NetStorage ■ Novell Client **NetWare** ■ Novell Remote Manager
User space quota management	**NetWare and Linux** ■ Novell iManager **Linux** Make sure users are Linux-enable with LUM before you set the quota. User space quotas are available in OES SP1 and later.
Default mount location for NSS pools	**Linux** ■ /opt/novell/nss/mnt/.pools
Default mount location for NSS volumes	**NetWare** ■ Server root **Linux** ■ /media/nss
Default mount location for devices managed by EVMS	**Linux** ■ /dev/evms
Minimum pool size	**NetWare and Linux** ■ 10 MB

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For details on the comparison of NSS on NetWare and Linux, see "Comparison of NSS on NetWare and NSS on Linux" on page 413 of the *Novell Storage Services File System Administration Guide* (nss_enu.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

NSS and EVMS on OES Linux

The default volume manager in OES Linux is the Linux Volume Manager (LVM).

However, to use NSS on the same drive that contains your boot volume and system volume, that drive must be managed by Enterprise Volume Management System (EVMS).

Unless you make your Linux swap and system volumes manageable by EVMS, you cannot create NSS data volumes on that drive.

The simplest solution is to put your swap and system volumes on one device, and then use different devices for your NSS volumes.

In other words, you must install Linux with EVMS as the volume manager of the system hard drive in either of the following scenarios:

- Your system has a single hard drive and you want to use its free space for NSS data volumes.
- Your system has multiple hard drives and you want to use free space for NSS data volumes from any drive that contains the Linux boot, system, or swap volumes.

For details on NSS and EVMS on OES Linux, see "Using EVMS to Manage Devices with NSS Volumes (Linux)" on page 409 of the *Novell Storage Services File System Administration Guide* (nss_enu.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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How to Install NSS on an OES Linux Server

NSS is not installed by default with Novell OES. Instead it is recommended as a post-installation procedure. However, NSS is a service that you must plan for before installing OES Linux.

If your system has a single hard drive, you must create an EVMS partition during the OES Linux installation (see “NSS and EVMS on OES Linux” on 5-52).

If your system has more than a single hard drive, you must still have EVMS partitions before you can create NSS volumes on an OES Linux server.

However, with more than one hard drive, you can create EVMS partitions after installation on the other hard drives that do not contain the system volumes.

Given that you have EVMS partitions to create NSS volumes on, you install NSS on OES Linux using the YaST utility by doing the following:

1. From YaST, select **System > Novell Storage Services (NSS)**.

   YaST displays a message indicating that NSS is not installed.
2. To install NSS, select **Continue**; then insert the requested CD.
3. After YaST installs and configures the NSS packages, you authenticate to the LDAP server so the NSS Unique Admin object can be created in eDirectory.

   YaST then returns to the Control Center page.
4. The NSS installation is complete and you can close YaST.

Once the installation is complete, you no longer use YaST for NSS tasks. You create and manage pools and volumes from iManager or or by using the nssmu command line utility.

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How to Use the NSSMU Management Utility in OES Linux

The Novell Storage Services Management Utility (NSSMU) is a console-based utility for managing NSS storage media on a server. You can use NSSMU at any time as an alternative to the browser-based iManager Storage plug-in.

For OES Linux, NSSMU is installed when you install NSS. The Linux installation creates symlinks in the /opt/novell/nss/sbin folder for common nss utilities, including NSSMU.

Symlinks allow the path to NSSMU to become part of the root user's path, which allows you to run it with the command nssmu.

The following lists some key functions available in NSSMU for Linux:

Table 5-4

Management Options	Description
Device Management ■ F1 = Help ■ F3 = Initialize device (do not initialize your system device) ■ F5 = Refresh display ■ F6 = Share (shareable/not shareable for clustering) ■ Enter = Show partitions	Use this menu option (and the listed keystrokes) to initialize and maintain physical storage devices and software RAID devices available to this server. See *Software RAID Devices* to create, repair, or delete RAIDs.
Pool Management ■ Ins = Create a pool ■ Del = Delete a pool ■ F3 = Expand a pool (add partitions) ■ F4 = Update NDSTM/eDirectory ■ F5 = Refresh details of the pool ■ F6 = Rename a pool ■ F7 = Activate/deactivate pools	Use this menu option (and the listed keystrokes) to create, delete, rename, and expand NSS storage pools to efficiently use all free space in the available devices.

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(continued) **Table 5-4**

Management Options	Description
Pool Management (*continued*) ■ F8 = More (list more options) ■ F9 = Show/Hide deleted volumes ■ F10 = List devices (that a pool resides on) ■ Enter = Show volumes (on a server or pool)	
Volume Management ■ Ins = Create an unencrypted volume ■ Del = Delete a volume ■ F2 = Rename mount point for the volume (new path with volume name) ■ F3 = Rename volume ■ F4 = Update NDS/eDirectory ■ F5 = Refresh details of the volume ■ F6 = View compression statistics ■ F7 = Dismount/mount a volume If it is encrypted, the volume prompts for a password on the first mount after a system boot or reboot. ■ F8 = More (list more options) ■ F9 = Name Space - choose Long, UNIX, DOS, Mac ■ Enter = Set or view volume properties	Use this menu option and the listed keystrokes) to create, delete, rename, activate/deactivate, and mount/dismount NSS volumes and to set their attributes. To store data in encrypted format, specify a password when you create the volume. This enables the Encryption attribute. The encryption setting persists for the life of the volume. The encryption password can be 2 to 16 standard ASCII characters, with a suggested minimum of 6. The password generates a 128-bit NICI key for encryption. You must supply the password on the first volume activated after a system boot or reboot. On Linux, you can mount encrypted volumes only from NSSMU the first time after a system reboot.

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(continued) **Table 5-4**

Management Options	Description
Volume Management (*continued*)	Provide the password when needed. Until you provide a password for encrypted volumes, you cannot mount multiple encrypted volumes simultaneously.
Software RAID Management ■ Ins = Create a software RAID device (0, 1, or 10) ■ Del = Delete a software RAID device ■ F3 = Expand a RAID device (add partitions) ■ F4 = Rename a RAID device ■ F5 = Refresh details of the software RAID device ■ F6 = Restripe (resume restriping for paused RAID 0) ■ Enter = Show segments (list member partitions for selected device)	Use this menu option and the listed keystrokes) to manage software RAID devices. A software RAID device emulates a hardware RAID device. RAID devices combine partitioned space on multiple physical devices into a single virtual device that you manage like any device. Each member device contributes an equal amount of space and only a single partition to the RAID.
Partition Management ■ Ins = Create an NSS partition ■ Del = Delete an NSS partition ■ F5 = Refresh details of the partition ■ F6 = Label ■ Enter =Show volumes	Use this menu option and the listed keystrokes) to view details about partitions. You can also delete a single partition when repairing a failed software RAID partition. To delete all software RAID partitions, delete the RAID itself.

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How to Assign File System Rights for NSS Volumes on OES Linux

To understand file system rights for NSS volumes on OES Linux, you need to understand the basics of how to do the following:

- Assign Rights to Users
- Assign Rights to Service Agents

Assign Rights to Users

The rights utility for Linux is available for managing file system trustees for directories and files in NSS volumes on Linux. It is similar to the rights utility for NetWare.

You can load rights from the command line of the server console.

File system rights for directories and files in NSS volumes on OES Linux can only be managed using the rights utility at the OES Linux command line or from the Novell Client at a client workstation.

File system rights for directories and files in NSS volumes on OES Linux cannot be managed through Remote Manager, iManager, ConsoleOne, or NW Admin. You must use the rights utility to manage file system rights.

eDirectory object rights to objects that represent NSS volume on OES Linux are managed through iManager, the same as for objects that represent NSS volumes on OES NetWare.

You start the rights utility from the command line. You must be authenticated as root to use this utility, unless the root user modifies permissions to the rights executable file, which is in the /sbin folder.

For example, to give the admin user permission to execute the rights command, change the owner to admin by entering **chown admin /sbin/rights**. You must be the root user to enter this command.

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The /sbin directory is not in the admin user's path by default. The admin user would have to enter /sbin/rights to invoke the rights utility, or the root user could add /sbin to the admin user's path.

Entering the rights command without any options displays help information as shown in the following:

Figure 5-12

```
DA2:/ # rights

THIS UTILITY WILL ONLY WORK WITH FILES IN THE NSS FILE SYSTEM

Usage: rights [OPTIONS]
       rights [TOPTIONS] trustee USERNAME
       rights [DOPTIONS] delete USERNAME
       rights [IOPTIONS] irf
       rights [EROPTIONS] effective [USERNAME]
       rights [SOPTIONS] show

The action to be taken is indicated by the first argument
   trustee     : Add or modify a trustee on a file/directory
   delete      : Remove a trustee from a file/directory
   irf         : Set the inherited rights filter on a directory
   effective   : Display a user's effective rights
   show        : Display the trustees and inherited rights filte

OPTIONS
   -v, --version        Display the program version information
   -h, --help           Display the help screen
TOPTIONS
   -r, --rights=MASK    The rights to be given to this trustee.
                        are assigned then the trustee is removed
                        not specified the default is read and fi
   -f, --file=filename  The name of file/directory to assign tru
                        If not specified the current directory i
DOPTIONS
   -f, --file=filename  The name of file/directory to delete tru
```

The rights utility is relatively simple to use.

For example, the second line in the usage section of the help page shows that the syntax for making a trustee assignment is

rights *[TOPTIONS]* **trustee** *USERNAME.*

The *[TOPTIONS]* variable represents the use of the -f and -r options. You use the -f option to specify a *directory/file* path name. You use the -r option to specify the rights you want to give to the trustee.

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The *directory/file* path name is based on the NSS volume's mount point in the OES Linux file structure, not on the name of the NSS volume.

For example, if you create an ifolderdata NSS volume and mount it at /var/nss/ifolder, /var/nss/ifolder is the directory path you would use with the rights command's -f option.

The *USERNAME* variable represents the fully distinguished name of the user, group, or container that you want to assign as an NSS trustee.

The rights help page also shows the convention you must use to indicate which rights you want to assign with the -r option. These are shown in the following:

Figure 5-13

```
USERNAME        The username is the name of an eDirectory object
                including the tree name
MASK            The mask is a string of characters with each character
                representing a type of rights:
                   s    Supervisor
                   r    Read
                   w    Write
                   c    Create
                   e    Erase
                   m    Modify
                   f    File scan
                   a    Access control
                   none No rights
                   all  All rights
```

For example, if you have an ifolderdata NSS volume mounted at /var/nss/ifolder and you want user KThorn to be a trustee with read, write, create, erase, modify, and file scan file system rights to the root of the ifolderdata NSS volume, you would enter the following:

rights -f /var/nss/ifolder -r rwcemf trustee kthorn.slc.da.da-tree

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Assign Rights to Service Agents

Novell services that can be hosted by either OES NetWare or OES Linux servers often use eDirectory user objects as agents for accessing the file system on whichever platform is hosting the service. These eDirectory user objects are called *service agents*.

iFolder is a good example of a service that uses a service agent. When iFolder is hosted by an OES Linux server, the novlifdr user object is the agent that is used to access the Linux file system and manage iFolder data files.

The novlifdr user belongs to the ifdrwww group. Both ifdrwww and novlifdr are LUM enabled.

iFolder is designed to be able to use either native Linux file systems or NSS volumes to store data. If, during installation, you configure iFolder to store data in a native Linux directory, the iFolder installation program automatically assigns novlifdr and ifdrwww as owner and group to that directory.

However, if you choose to store iFolder data on an NSS volume, you must manually assign novlifdr as a file system trustee of the NSS volume, and give novlifdr all file system rights.

For example, assuming that the NSS volume iFolder is configured to use is mounted at /var/nss/ifolder, the command to make this trustee assignment is

rights -f /var/nss/ifolder -r all trustee novlifdr.slc.da

Because NSS file system rights and native Linux file system rights are not related, it doesn't matter what owner or group is assigned to an NSS volume. The only file system rights that matter on NSS volumes are those assigned through the rights utility.

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Exercise 5-2 Install and Configure NSS on the DA1 Linux Server

Now that you have reviewed OES file systems, NCP servers, and NSS, you are ready to begin Exercise 5-2.

NCP server and SMS backup services are installed by default in the Novell OES for Linux installation. However, for the purposes of this exercise, NCP and SMS were deselected at install time.

NSS is not installed by default in the Novell OES for Linux installation.

When you install NSS on the DA1 Linux server in this exercise, you also select the NCP packages for installation. In addition, when you install NSS, the SMS backup services packages are selected for you because NSS is dependent on SMS.

Exercise 5-2 Install and Configure NSS on the DA1 Linux Server is in your *Integrating Novell Open Enterprise Server Workbook for Linux* on page 5-17.

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Objective 7 Migrate NSS Volumes Using the Server Consolidation Utility

Novell OES with Support Pack 2 provides an NSS volume migration tool in the Server Consolidation Utility. Before beginning an NSS volume migration, you should review the following:

- Meet System and Software Requirements
- Understand NetWare-to-Linux Data Migration Issues
- Prepare the Source and Destination Servers
- Create and Run a Consolidation Project

Meet System and Software Requirements

Linux destination servers must be installed and running Open Enterprise Server with the following components enabled:

- Novell eDirectory
- Novell NCP Server for Linux
- Novell Storage Services (NSS), if copying data from NetWare source servers
- Novell Storage Management Services (SMS)
- Novell Linux User Management (LUM)

If you are copying data from NetWare source servers, one or more NSS volumes must be created and configured on the Linux destination server. These are the only volumes where you can drop folders in the Server Consolidation Utility project window.

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Understand NetWare-to-Linux Data Migration Issues

Before using the Server Consolidation Utility to copy data from NetWare servers to OES Linux servers, you should be aware of the the following issues:

- **Open Files Cannot Be Copied**. The Server Consolidation Utility cannot copy files that are open and currently in use.

  There is one exception to this rule. NSS has a feature called File Copy on Write. This permits a file that is being changed to be accessed in the same state as it was in when it was last closed by all processes.

  This feature is enabled on an NSS volume either by using ConsoleOne or by entering the following at the source server console:

  nss /filecopyonwrite=*volname*

  For example, nss /filecopyonwrite=vol1 would enable File Copy on Write for the vol1: volume. The effect is immediate, but it affects only files that are currently closed and then opened later.

- **Cluster Failover Stops File Copy**. If you run a server consolidation project involving a NetWare cluster and the cluster fails over during the consolidation, the file copy will stop. The consolidation project must be run again.

- **Use of SMS to Copy Data**. The Server Consolidation Utility uses Storage Management Services (SMS) as its file copy engine to copy data from NetWare servers to OES Linux servers.

  Using SMS preserves as many of the NetWare trustee rights and file/directory attributes as possible.

- **New attrib Command for OES Linux**. If you copy files from a NetWare source server that have the Delete Inhibit attribute set, the files cannot be deleted from the destination NSS volume on an OES Linux server using the standard Linux or Windows utilities.

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Novell has provided a new attrib command for OES Linux that lets you remove the Delete Inhibit attribute, as well as set or modify other supported NetWare attributes on Linux. For more information, enter attrib -h to view the online help.

- **Creation Dates Change from NetWare to Linux**. After copying files from a NetWare source server to an OES Linux destination server, the creation dates for those files change to today's date rather than the date the files were originally created.

  Linux doesn't provide a Creation Date field for file systems, so NCP Server displays the current date.

- **Migrating Macintosh Files from NetWare to Linux**. If the Server Consolidation Utility encounters files with Macintosh resource forks (supported in early versions of NCP), the resource forks are not copied to the Linux server.

  However, if you use Macintosh-based backup/restore tools that use AppleTalk Filing Protocol (AFP) when migrating Macintosh files to a Linux server, you won't lose any of the Macintosh-specific metadata.

- **NFS Name Space Required when Copying Data from a Traditional File System (TFS) on NetWare to NSS on Linux**. You can transfer data from a traditional NetWare file system (non-NSS) volume on NetWare to an NSS volume on OES Linux.

  Transferring data from TFS requires that you first install NFS name space support on the traditional NetWare volume.

  Without the NFS name space loaded, the Server Consolidation Utility file copy fails and displays an error message indicating there is not enough disk space.

- **Disable Server Consolidation Utility File and Folder Comparison**. Novell recommends that you do not enable the Compare Files and Folders verification when copying data from NetWare to Linux.

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If you do enable this check, you should expect to see many errors reported in the log file, because of the inherent differences in how Linux stores file system data.

- **Enable UTF-8 Encoding on NCP Client for the Server Consolidation Utility (SCU)**. You can use the Server Consolidation Utility to copy data from servers storing double-byte character set data (Japanese, Korean, and other non-ASCII characters) or extended ASCII character data (multinational characters).

  To copy data with non-ASCII or extended ASCII characters, you must enable UTF-8 support in the Novell Client 4.91 for Windows 2000/XP to prevent trustees and ownerships from being lost.

  UTF-8 support is turned off by default.

- **Understanding the Need for Linux-Enabling Users**. When you use the Server Consolidation Utility to copy data from NetWare servers to NSS volumes on an OES Linux server, it transfers the NetWare trustee rights and supported file and directory attributes along with the files.

  However, in order to preserve file ownerships, the users must be Linux enabled (also known as LUM enabled because the process involves the Linux User Management service in OES).

  To become Linux or LUM enabled, an eDirectory User object must be associated with an eDirectory Group object. The Group object must be associated with an eDirectory Linux Workstation object that represents the physical Linux workstation/server.

  The Group object is necessary because NSS on Linux uses Virtual File Services (VFS), which requires both a User ID and a Group ID to authorize access.

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For complete details on Linux (LUM) enabling users for OES Linux, see the *Novell Linux User Management Technology Guide*. (lumadgd.pdf).

The guide is available at http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD.*

- **Maintaining File Ownership Information**. To maintain file ownership information when copying data from NetWare volumes to NSS volumes on OES Linux, Novell recommends that you Linux-enable your users with LUM *before* copying their data.

  If you Linux-enable users after their data has been copied to an OES Linux server, the file ownerships might not be re-established immediately on the destination NSS volume.

  If you use the nambulkadd command to Linux enable your users, the user IDs are updated immediately upon completion of the command.

  However, if you Linux enable users individually with iManager, ConsoleOne, or the namuseradd command, it could take up to four hours before the user IDs are updated.

  You can have the update ID process occur immediately by running the refreshids command after Linux-enabling the user.

For complete details on using the nambulkadd command, see “nambulkadd” on p. 37 of the *Novell Linux User Management Technology Guide*. (lumadgd.pdf).

The guide is available at http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD.*

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Prepare the Source and Destination Servers

Before you launch the Server Consolidation Utility from the Server Consolidation and Migration Toolkit, you must prepare the source and destination servers by completing these steps:

1. Ensure that all source and destination servers are running supported versions of NetWare, Linux, or Windows server software.

   For complete details on supported versions of NetWare, Linux, or Windows, see “Supported Source and Destination Server Versions” on p. 18 of the *Novell Server Consolidation and Migration Toolkit*. (scmt11.pdf).

   This guide is available at http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

2. If necessary, apply the latest NetWare or Open Enterprise Server (OES) Support Packs on both source and destination NetWare or OES servers.

3. If copying data from and to NetWare servers, set the same code page for both the source and destination servers.

   If both servers don't have the same code page, data will be lost during the consolidation.

   For complete details on changing your server's code page, see “Changing the NetWare Server Code Page” on p. 118 of the *Novell Server Consolidation and Migration Toolkit* (scmt11.pdf).

   This guide is available at http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

4. As a precaution, you should have a current backup of all file system and eDirectory data on the destination servers.

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You should have a current data and trustee backup of the source servers, even though the source data is not modified during a data consolidation project. The only time data is changed on the source server is when you are consolidating printers.

5. For NetWare/eDirectory consolidations, load the latest SMS Storage Management Data Requestor (smdr.nlm) and Target Service Agent (tsafs.nlm) modules on your source and destination NetWare servers.

   To load the SMS modules provided with the NetWare operating system software, enter **load smdr** and **load tsafs** at the server console command prompt.

6. If you are consolidating data to OES Linux servers, load the SMS modules on Linux by entering these commands at the shell prompt:

   /etc/init.d/novell-smdrd start
   /opt/novell/sms/bin/smsconfig -l tsafs

7. Depending on how you have set up service discovery on your network, you might need to add the source server's IP address, DNS name, and localhost name to the sys:/etc/hosts file on the destination server, and vice versa.

Create and Run a Consolidation Project

Before you create and run a consolidation project, you should be familiar with the following consolidation project phases:

- Install the Server Consolidation and Migration Toolkit
- Launch the Server Consolidation Utility and Create a Project File
- Select a Source and Destination Tree
- Model Your Consolidation Project
- Perform Pre-Copy Verifications
- Additional Steps for Tree-to-Tree Consolidations
- Run the Consolidation

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Install the Server Consolidation and Migration Toolkit

The Novell Server Consolidation and Migration Toolkit is located on *NetWare 6.5 CD 1 (Operating System)* or on *Open Enterprise Server NetWare OS CD* in the products\Migration_Utilities directory. The self-extracting file is named scmt.exe.

You can also install the version on the CD through the *Consolidate or Migrate Servers* option in the Novell Deployment Manager utility.

The latest version of the toolkit can be downloaded from the Novell Downloads page (http://www.novell.com/download). You should use the latest version whenever possible.

To install the Server Consolidation and Migration Toolkit on the workstation, do the following:

1. Obtain the self-extracting file from the NetWare operating system CD or from the Novell downloads site and copy it to your workstation.
2. Double-click the scmt.exe file to launch the installer; then select **Next** to proceed.
3. (Conditional) If you see a prompt indicating you don't have the correct version of the Novell Client software installed, use the prompt's link to download and install the Novell Client software and then restart the toolkit installation.
4. (Conditional) If you are prompted to remove an earlier version of either NetWare Migration Wizard or Server Consolidation Utility, answer **Yes**; then select **Next > Uninstall > Done**.
5. Accept the license agreement; then select **Next**.
6. Read the Readme file; then select **Next**.
7. Specify where you want to install the toolkit; then select **Next**.

   By default, the toolkit is installed in c:\program files\novell server consolidation and migration toolkit.

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8. Specify whether you want to create desktop and quick launch icons; then select **Next**.
9. Verify your installation information; then select **Install**.
10. You must reboot the workstation to complete the installation. To reboot when the installer exits, select **Yes**.

Launch the Server Consolidation Utility and Create a Project File

The Server Consolidation Utility is a Windows program that is launched from the Server Consolidation and Migration Toolkit.

1. If you have not already done so, start the Server Consolidation and Migration Toolkit.

   By default, the toolkit is installed in c:\program files\novell server consolidation and migration toolkit. You can access it by selecting the following:

   Start > Programs > Novell Server Consolidation and Migration Toolkit > Novell Server Consolidation and Migration Toolkit
2. Read the Welcome page; then select **Create or Open Project**.
3. Select **NetWare or Open Enterprise Server (eDirectory)**; then select **Next**.
4. Select **Consolidate and Copy Data and Printing Between Servers**; then select **Next**.
5. Read the About screen; then select **OK**.
6. Do one of the following:
   - To start a new consolidation project, select **Create a New Project > OK**.

     Continue with Step 7.
   - To open an existing project, select **Open an Existing Project > OK**, select the project you want to work on; then select **Open**.

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Skip to “Model Your Consolidation Project” on 5-72.

- To open the last project you worked on, select **Open Last Project > OK**.

  Skip to “Model Your Consolidation Project” on 5-72.

  The Server Consolidation Utility uses a project (.mdb) file to record your intended actions. The actions are recorded so you can execute them now or save the project file and execute the actions later.

7. Type a ***project filename*** in the field provided.

   The filename can be up to 64 characters long and can include any character except \ * ? < > | " /. The project name also serves as the project's folder name, so you might want to keep it short.

   The project folder stores the log files and other files associated with the project.

8. (Conditional) If you want to store the project file in a location other than the default location provided, select **Browse** and navigate to the desired location; then select **OK**.

9. Select **Next** to continue to the next screen and begin the next phase of the consolidation project to select a source and destination tree.

Select a Source and Destination Tree

After you create a project file, you need to select your source and destination trees. To do this, you must be logged in to the trees that you will be working in.

1. Select the source and destination eDirectory tree from the drop-down list provided or select **Login** to browse to a tree that is not in the drop-down list.

   Only trees that you are currently logged in to are available on the drop-down list.

   Log in by doing the following:

   a. In the Novell Login dialog box, select **Trees**.

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b. Browse to each desired tree and log in with the correct ***username*** and ***password***.

If you do not know the tree name, in the Server field of the Login dialog box, enter the ***IP address*** or ***DNS name*** of the server that you will be consolidating to or from.

If you are performing a consolidation to an Nterprise Branch Office appliance, the Admin user's context is always appusers.

c. Select **OK**.

2. Select **Next**.
3. Select **Create** to finish creating the project file.

The Project Window appears. From here you begin the next phase, which is modeling your consolidation project.

Model Your Consolidation Project

The Project Window is where you select which volumes and directories to copy and which Printer objects to move.

You use the Server Consolidation Utility to migrate printers from NetWare to Linux in Section 7 of this course.

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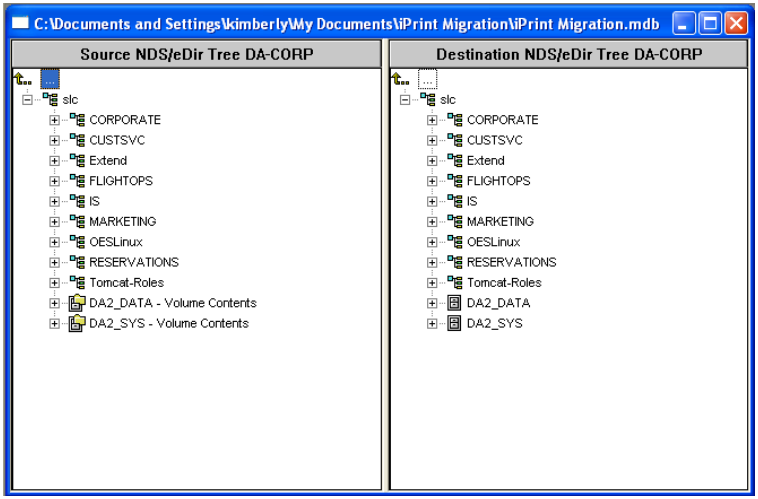
The Project Window is divided into two panes that each show the trees that you are working in, as shown in the following:

Figure 5-14



From the Project Window you drag objects from the left pane and drop them into the right pane. You select volumes and directories to copy to different servers (and Printer Agents to move to different Print Managers).

You can also create new eDirectory containers or file system folders by right-clicking on an existing container or folder and selecting New Container or New Folder from the pop-up menu.

Creating containers and folders and dragging and dropping objects in the Project Window does not immediately perform the action. It only creates (models) a preview of where the files and objects will reside. The actions are completed only after the verification process is complete and the copy process begins.

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Volume Drop Options

When you drag and drop volumes into the right pane of the Project Window, a Volume Drop Options dialog box displays. You must choose to either migrate the volume contents into the directory or volume that you selected or create a new directory with the name of the volume that is being moved.

1. Select the radio button next to the ***option*** you want.
2. Select **OK**.

Duplicate Folder Options

If you drag and drop a folder onto a destination folder of the same name, a Duplicate Folder Options dialog box displays. You have several options:

- **Don't Copy the Directory.** The directory on the source server is not copied and the directory on the destination server is not replaced.
- **Merge Directory Contents.** The contents of the source directory are merged into the destination directory with the same name.
- **Rename.** The directory on the source server is copied to the destination server with a new name assigned to it. You must enter a new name in the field provided if you select this option.
- **Merge All.** If you are dragging and dropping multiple directories at once, select this option if you want to merge the contents for all duplicate directories.

Do the following:

1. Select the radio button next to the ***option*** you want.
2. Select **OK**.

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Other Project Window Options

In addition to dragging and dropping objects, you can perform several other tasks from the Project Window menu:

- Save project settings: Select **File > Save As**.
- Move created and dropped objects around by dragging them to the desired ***location***.
- Create a new container or folder: Select the parent container or existing folder in the right pane; then select **Edit > New Folder**.
- Cancel a "dropped" action: Select the volume or directory in the right pane; then select **Edit > Back Out**.
- Rename a newly created container or folder: Select the parent container or existing folder in the right pane; then select **Edit > Rename**.
- Show where a folder or object went: Select the object in the left pane; then select **Edit > Where Did It Go**. The directory or volume that was moved is highlighted in its new location in the right pane.
- Show where a folder or object came from: Select the object in the right pane; then select **Edit > Where Did It Come From**. The directory or volume that it came from is highlighted in the left pane.
- Show all folders or objects selected for copying: Select a container in the left pane; then select **Edit > Show Dropped Folders** (or **Show Dropped Printers**).

The previous six tasks can also be performed by right-clicking the object to see the same menu options.

- View the available disk space before performing the verification by right-clicking the ***destination volume*** in the right pane of the Project Window and then selecting **Properties**.

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Right-clicking the ***source folder*** or volume in the left pane of the Project Window and then selecting **Properties** displays the size of the source object.

After you have modeled your consolidation project, you are ready to move on and perform pre-copy verifications.

Perform Pre-Copy Verifications

After you have completed the modeling tasks necessary for your consolidation project, proceed by selecting **Project > Verify and Copy Data** from the menu or by selecting **Do the Consolidation** from the button bar.

The pre-copy verification phase includes the following:

- Verification Initialization
- Duplicate File Resolution
- Synchronize Files and Folders
- File Comparison
- File Date Filters
- Excluded File Extensions
- Check for Trustees and Ownership
- Password Verification
- Check for Sufficient Disk Space and Disable Login
- Verification Wizard
- (If necessary) Resolve Pre-Copy Verification Errors

Verification Initialization

Do the following:

1. When the Verification Wizard dialog box is displayed, select **Next** to begin the verification process.

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2. The Dropped Folders dialog box appears, showing the source path and destination path for the dropped folders. Do one of the following:
   - If the source and destination paths are correct, select **Next**.
   - If the source or destination path is incorrect, select **Cancel** and make the appropriate changes in the Project window.
3. (Conditional) If you created new folders in the right pane of the Project window as part of your consolidation project, the Created Folders dialog box appears.

   Do one of the following:
   - If the destination path of the created folders is correct, select **Next**.
   - If the destination path is not correct, select **Cancel** and make the appropriate changes in the Project window.
4. (Conditional) If you are moving NDPS printers as part of your consolidation project, the Dropped Printers dialog box appears.

   Do one of the following:
   - If the destination locations of the printers are correct, select **Next**.
   - If the destination locations are not correct, select **Cancel** and make the appropriate changes in the Project window.

Duplicate File Resolution

If a file is found on the destination volume or directory that has the same name as a file being copied from the source, you must decide what to do.

You have the following options to choose from in the Duplicate File Resolution dialog box:

- Don’t copy over existing files

  The file on the source server is not copied and the file on the destination server is not replaced.
- Copy the source file if it is newer (Default)

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If the file on the source server is newer than the one on the destination server, the file on the destination server is replaced.

- Always copy the source file

  The file on the source server always replaces the file with the same name on the destination server.

1. Select the radio button next to the ***option*** you want.
2. Select **Next**.

Synchronize Files and Folders

In the Synchronize Files and Folders dialog box, you have the option to delete files and folders on the destination server that do not exist on the source server. Selecting Yes deletes all files and folders on the destination server that are not on the source server. No is the default selection.

1. Select the radio button next to the ***option*** you want.
2. Select **Next**.

Do not use this option in projects that involve consolidating data from two separate volumes or folders on the source server into a single volume or folder on the destination server.

When the synchronization check compares the copied data to what exists in the first volume or folder, it will delete everything that was copied from the second.

The same process occurs when comparing the copied data for the second volume or folder, and you end up with no copied data remaining in the destination volume or folder.

File Comparison

In the File Comparison dialog box, you have the option to compare files and folders between the source and destination servers after the copy process completes.

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Selecting Yes compares the following information between the source and destination files and folders:

- Names
- Dates
- Sizes
- Attributes
- Trustees
- Owners

The File Comparison component of the Pre-Copy Verification phase includes the following steps:

1. (Conditional) If you do not want to compare source and destination files after the copy process, select **No**; then select **Next**.

   Skip to the File Date Filters component of the Pre-Copy Verification phase.

2. (Conditional) If you do want to compare source and destination files after the copy process, select **Yes**.

   You can also choose to perform a binary (byte-by-byte) comparison of the files after the copy process finishes. This option gives the greatest assurance that two files are identical, but it takes longer to complete.

   To perform a binary comparison of the files that were copied, select **Binary (byte-by-byte) comparison**; then select **Next**.

3. (Conditional) If errors are returned about files having different Rename inhibit (Ri) and Delete inhibit (Di) attributes after the comparison, you can disable the comparison of these attributes by *deselecting* **Compare Ri/Di attributes on read-only files**.

   These errors arise because the Novell Client version 4.9*x* does not automatically set the Di or Ri attributes when copying Read-only files, but the Server Consolidation Utility does.

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If you have copied Read-only files to the source server using the Novell Client, they are marked Read-only, but the Di and Ri attributes are not set by the Client.

If you then use the Server Consolidation Utility to copy these files to another server, the utility sets the Di and Ri attributes of all Read-only files on the destination server, as it should.

4. Select **Next**.

You should not enable file comparison when copying files from NetWare to OES Linux servers. Many differences exist between the file and folder attributes supported on NetWare and those supported on Linux. Because of these differences, you see a large number of errors in a file comparison.

File Date Filters

In the File Date Filters dialog box, you have the option to copy files based on dates and three separate attributes:

- Accessed
- Modified
- Created

If you select No, all files are copied. If you select Yes, you can enter date ranges for the file copy. You can specify as many criteria as you need, and only those files that meet all of the selected criteria are copied.

Two dates can be set for each attribute:

- **The On or Before date**. For example, if you select only On or Before and set the date for November 10, 2000, for the Accessed attribute, only those files accessed on or before November 10, 2000, are copied.

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- **The On or After date**. If, for example, after setting the On or Before date to November 10, 2000, you also specify an On or After date of October 1, 2000, only those files accessed on or after October 1, 2000, and on or before November 10, 2000, are copied.

Do the following:

1. (Conditional) If you do not want to filter files based on dates, select **No**.
2. (Conditional) If you want to filter based on dates, select **Yes**; then select the desired combination of file types and dates to be copied.

   To change the date from the default provided, check the box next to the desired date. Next, highlight with your mouse the portion of the date you want to change. Either type a new value using the keyboard number pad, or use the up- and down-arrows provided to the immediate right of the date field.
3. Select **Next**.

Excluded File Extensions

In the Excluded File Extensions dialog box, you have the option to exclude specific file types or file names from the copy process. Wildcards are permitted.

The two most commonly used wildcards are

- **The question mark (?)**. This wildcard is used to represent a single alphanumeric character in a search expression.

  For example, typing te?t.txt would exclude tent.txt, test.txt, and text.txt from the copy process.
- **The asterisk (*)**. This wildcard is used to specify zero or more alphanumeric characters in a search expression.

  For example, typing h*s.txt would exclude house.txt, his.txt, horses.txt, and happiness.txt from the copy process.

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Do the following:

1. Type the file extension types or filenames in the field provided. For multiple filenames or types, press **Enter** between each entry.

   For example, if you want to exclude a specific file named test.txt from being copied, enter test.txt in the field provided. If you want to exclude all .mp3 files from being copied, type *.mp3 in the field provided.

   Type as many filenames or file extension types as you want. Separate the filenames or file extensions by pressing Enter between each entry. Do not use spaces or commas to separate the entries. See the following examples:

   - Entries *correctly* separated by pressing **Enter**:

     *.mp3
     test.txt
     *.wav

   - Entries *incorrectly* separated by spaces or commas:

     *.mp3 test.txt *.wav
     *.mp3, test.txt, *.wav

2. Select **Next**.

Check for Trustees and Ownership

If you are performing a consolidation between servers in the same eDirectory tree, files and folders are checked for trustees and ownerships by default so the Check for Trustees and Ownerships dialog box is not displayed.

Skip to the Verify Password component of the Pre-Copy Verification phase.

When you copy data from one tree to another, the Server Consolidation Utility searches the destination tree for objects whose names match the source tree object names.

Objects that are potential matches are displayed and can be matched up during Tree-to-Tree Object Match Up.

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If the Check for Trustees and Ownerships option is enabled, the Server Consolidation Utility scans the dropped folders and their subordinate folders for trustees and owners. This check must be performed the first time a consolidation is run.

If a consolidation is run a second time, this scan does not need to be repeated, as long as trustees have not been added to the source server and new directories or folders have not been dropped onto the destination server; otherwise, another scan is necessary.

Checking for trustees and ownerships slows down the verification process.

If a file has already been copied to the destination server or tree, that file's trustees are not updated during the consolidation unless the source file data is recopied.

See "Duplicate File Resolution" on 5-77 for information about when a source file might overwrite the destination file.

Do the following:

1. Select **Browse** to specify the destination container you want to search.
2. Select **Search All Subordinate Containers** to search the specified container and all subordinate containers in the destination tree.

   If you don't select this option, the utility searches only the selected destination container.

   For better performance, limit the search to the container that you believe the object resides in. Searching from [root] takes significantly longer, depending on the size of the destination tree.
3. Select **Next**.

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If you are consolidating data to an Nterprise Branch Office appliance, you cannot specify the container you want to search. Select **Yes** or **No**; then select **Next**.

Password Verification

The Server Consolidation Utility uses SMS as the backup and copy engine. SMS requires that the servers involved in the consolidation be authenticated to each other.

Do the following:

1. In the Password Verification dialog box, enter the ***passwords*** for the source and destination trees in the fields provided.
2. Select **Next**.

Check for Sufficient Disk Space and Disable Login

Before beginning the data consolidation, you can verify that the destination volumes have enough space to accommodate the data that will be moved. Verifying disk space can be a long process if you have many files to copy.

You can also disable login on the source server before copying file data. Users already logged in to the source server are not logged out, but no new logins are allowed until the consolidation is completed.

If you disable login and the workstation running the consolidation project crashes for any reason during the consolidation, you might have to manually re-enable login at the source server console.

Do the following;

1. To verify the available space on the destination volumes, select **Check for Sufficient Disk Space**.
2. To have the utility disable login on the source server prior to copying data, select **Disable Login**.
3. Select **Next**.

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After you complete this component, the Verification Wizard screen appears.

Verification Wizard

Do the following:

1. When the Verification Wizard screen appears, select **Next** to begin the pre-copy verification.
2. (Conditional) During the verification process, you might see a message informing you that an updated tsafs.nlm or smdr.nlm must be copied for the consolidation to work. Continue the project verification by selecting **Yes**. Select **No** to stop the verification.

Resolve Pre-Copy Verification Errors

If errors are discovered in the verification attempt, they are shown in the Error Resolution dialog box. Errors could include name conflicts, insufficient rights, required name spaces not loaded, and insufficient disk space. Errors found during the verification process are classified as follows:

Critical errors must be resolved before files can be copied.

Warnings should be resolved but might not affect the copy process.

A description of the error and a possible resolution appears in the Information text box. If no resolution is provided, you can find more information in the Novell Error Code online documentation. (Search the system by error code number.)

In addition to critical errors and warnings, the Error Resolution dialog box might display informational text classified as follows:

Information about the decisions you made in the Project Window.

After resolving any errors that exist, select **Next**.

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If you are migrating NSS volumes from one tree to another, the Tree-to-Tree Object Match Up dialog box appears.

If you are migrating data from NSS volumes on one server to NSS volumes on another server in the same tree, the Start Novell Server Consolidation Utility dialog box appears.

Additional Steps for Tree-to-Tree Consolidations

If you are moving objects from one tree to another, the Tree-to-Tree Object Match Up dialog box appears. If you are not moving objects between trees, skip to “Run the Consolidation” on 5-86.

In Exercise 5-3 “Migrate the DATA Volume from the DA2 NetWare Server to the DA1 Linux Server” on 5-23, you do not perform a tree-to-tree migration. Instead, you migrate data from server to server within the same tree.

For complete details on tree-to-tree migrations, see “Additional Steps for Tree-to-Tree Consolidations” on p. 50 of the *Novell Server Consolidation and Migration Toolkit*. (scmt11.pdf).

This guide is available at http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD.*

Run the Consolidation

After resolving pre-copy verification errors, the Start Novell Server Consolidation Utility dialog box appears. Copy your files by selecting **Proceed**.

During the copy process, new folders and objects are created, files are copied, and Printer Agents are moved to their destination (as specified in the right pane of the Project Window).

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When the copy process is complete, a Process Finished screen appears. This screen lets you

- View the error log.
- View the success log.
- Close the Process Finished screen.

You can also view the error and success logs of any completed project from the Project Window by opening the project file and selecting **View > Error Log** or **View > Success Log**, or by selecting the corresponding button on the button bar.

If you interrupt the copy process before it is completed, all objects, directories, and files already copied to the destination server will remain there unless you manually delete them.

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Exercise 5-3 Migrate the DATA Volume from the DA2 NetWare Server to the DA1 Linux Server

Now that you have reviewed how to use the Server Consolidation Utility to migrate data from NSS volumes on OES NetWare to NSS volumes on OES Linux, you are ready to begin Exercise 5-3.

Exercise 5-3 Migrate the DATA Volume from the DA2 NetWare Server to the DA1 Linux Server is in your *Integrating Novell Open Enterprise Server Workbook for Linux* on page 5-23.

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Summary

Objective	Summary
1. Configure Time Synchronization on Novell OES	In this objective you learned how to use Network Time Protocol (NTP) to maintain a common time for all the servers in your network. You learned to do the following: ■ Identify Network Time Protocol Basics ■ Configure NTP on Your Network
2. Configure eDirectory with ndsconfig	In this course, you move an OES Linux server from its own eDirectory tree in to an existing eDirectory tree with a NetWare server. You can accomplish much of this by using the eDirectory YaST module. However, for consistent reliability, Novell recommends that you use the ndsconfig utility to either install the server into an existing tree. Using ndsconfig, you can ■ Create a Tree ■ Add a Server into an Existing Tree ■ Remove a Server from the Tree

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Objective	Summary
3. Configure eDirectory Users to Access an OES Linux Server	In this objective you learned that users and groups on Linux servers are managed according to the POSIX (Portable Operating System Interface) standard. Because Novell OES provides services running on both Linux and NetWare, Novell has developed a technology that lets eDirectory users also function as POSIX users on Linux servers. This technology is called Linux User Management or LUM. You learned the following: ■ LUM Fundamentals ■ How to Implement LUM ■ How to Enable eDirectory Users for Linux Access
4. Describe Novell OES Storage Solutions	In this objective, you learned the following: ■ File System Support in Novell OES ■ NetWare Core Protocol Support (Novell Client Support) on Linux ■ Storage Options ■ OES File Storage Planning
5. Provide File Access with NCP Server	In this objective, you learned that Novell Client for Windows is the long-standing software solution for providing NCP-based access to NetWare data from Windows workstations.

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Objective	Summary
5. Provide File Access with NCP Server (*continued*)	It supports traditional Novell protocols such as NCP, RSA, and NDAP, and it interoperates with open protocols such as LDAP. Because NCP is now available on OES Linux, Novell Client users can attach to OES Linux servers as easily as they have been able to attach to NetWare servers. The NCP Server for Linux enables support for login script, mapping drives to OES Linux servers, and other services commonly associated with Novell Client access.
6. Configure Novell Storage Services	In this objective you learned that before you install and configure Novell Storage Services (NSS) on your OES Linux or OES NetWare server, make sure you are familiar with the following: ■ What NSS Is ■ NSS Benefits ■ NSS Pools and Volumes ■ Comparison of NSS on NetWare and NSS on Linux ■ NSS and EVMS on OES Linux ■ How to Install NSS on an OES Linux Server ■ How to Use the NSSMU Management Utility in OES Linux ■ How to Assign File System Rights for NSS Volumes on OES Linux

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Objective	Summary
7. Migrate NSS Volumes Using the Server Consolidation Utility	In this objective you learned that Novell OES with Support Pack 2 provides an NSS volume migration tool in the Server Consolidation Utility. Before beginning an NSS volume migration, you should review the following: ■ Meet System and Software Requirements ■ Understand NetWare-to-Linux Data Migration Issues ■ Prepare the Source and Destination Servers ■ Create and Run a Consolidation Project

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SECTION 6 Access Data on an OES Linux Server Using CIFS/Samba

In this section, you configure and implement file system access to data on an OES Linux server using CIFS/Samba.

Objectives

1. Describe the Purpose of Novell Samba
2. Describe the Purpose and Architecture of Universal Password
3. Install Novell Samba and Configure Samba Users
4. Describe the Purpose of the Novell Samba Components

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Introduction

As a network engineer, providing access to network file systems is one of your top priorities. With NetWare servers, access from Windows clients to NetWare servers is accomplished primarily through the Novell Client Protocol (NCP).

With Novell OES and Linux servers and workstations, you have other scenarios to consider in addition to the Windows client/NetWare server scenario.

For example, you will probably have to consider a Windows client accessing files on an OES Linux server. You might also have to provide for file system access from Linux clients to either OES NetWare or OES Linux servers.

Linux servers and workstations also provide file access protocols that you might not have worked with in the past. Or, if you have worked with them, Novell OES provides file access deployment options that you didn’t have before.

In this section, you learn how to configure and deploy file access using CIFS/Samba.

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Objective 1 Describe the Purpose of Novell Samba

The following topics provide a brief introduction to the Novell Samba implementation:

- Samba, SMB, and CIFS
- Samba Roles for Novell OES Servers

Samba, SMB, and CIFS

Samba in Novell OES is a file access service that lets you use the Server Message Block (SMB) networking protocol with Linux computers and other platforms.

The first iteration of the SMB protocol was developed by IBM in the 1980s. An SMB implementation was developed for network file and print access in the UNIX operating system in the early 1990s.

The SMB protocol was later adopted and deployed as the Common Internet File System (CIFS) by Microsoft for use in Windows 95 and NT. CIFS is currently the foundation of networked file and print access in the Windows operating system.

Novell OES fully supports the Samba file access protocol. By default, NSS volumes hosted by an OES NetWare server can be accessed from a Samba client. OES Linux servers natively support both Samba server and Samba client functionality.

Samba Roles for Novell OES Servers

Samba lets Novell OES servers function in the following roles:

- **OES Linux as a File Server for Windows Clients.** Because Microsoft's CIFS protocol and Samba are both based on SMB, they are highly compatible. A Samba share on a Linux server looks the same to a Windows client as a CIFS share on a Windows server.

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Any CIFS-/SMB-compatible client can attach to a Samba share on an OES Linux server.

- **OES Linux as a Windows Client.** A Samba client on a Linux desktop attaches natively to Windows file and print services. No special configuration is necessary.

  The Samba client does not know whether the CIFS-/SMB-based services originate from a Windows server or a Linux server.

- **OES NetWare as a File Server for CIFS-/SMB-clients**. NSS volumes on OES NetWare servers are configured as CIFS shares and support the SMB protocol by default.

  This means that eDirectory users with the correct file system rights can access an NSS volume from a Windows or a Linux desktop using any CIFS-/SMB-compatible client.

For details on Novell Samba, see “Novell Samba” on page 214 of the *Novell Open Enterprise Server: Planning and Implementation Guide* (implgde.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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Objective 2 Describe the Purpose and Architecture of Universal Password

When users access CIFS or Samba shares on OES servers (NetWare or Linux), they authenticate through eDirectory using Universal Password, not their eDirectory password.

Before deploying CIFS or Samba as a file access solution on your network, you should the following about Universal Password:

- Why Universal Password
- Universal Password Security
- Universal Password Deployment Steps

Why Universal Password

Novell Open Enterprise Server (OES) software is designed to allow you to integrate heterogeneous systems and allow for native systems to interoperate.

The traditional Novell password has proven troublesome as an authentication solution in an integrated heterogeneous environment, so Novell introduced Universal Password.

Universal Password is a way to simplify the integration and management of different password and authentication systems in a coherent network.

In the past, administrators had to manage multiple passwords (simple password, NDS password, enhanced password) because of password limitations. Administrators also had to deal with keeping the passwords synchronized:

- **NDS Password.** The older NDS password is stored in a hash form that is non-reversible in eDirectory. Only the NDS system can make use of this password, and it cannot be converted into any other form for use by any other system.

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- **Simple Password.** The simple password was originally implemented to allow administrators to import users and passwords (clear text and hashed) from foreign LDAP directories such as Active Directory and iPlanet.

  The limitations of the simple password are that no password policy (minimum length, expiration, etc.) is enforced. Also, by default, users do not have rights to change their own simple passwords.

- **Enhanced Password.** The enhanced password offers some password policy, but its design is not consistent with other passwords. It provides a one-way synchronization and it replaces the simple or NDS password.

  To ensure that the password is secure, NMAS uses either a DES key or a triple DES key (depending upon the strength of the Secure Domain Key) to encrypt the data in the NMAS Secret and Configuration Store.

Universal Password was created to address these password problems. It provides

- One password for all access to eDirectory
- Enables the use of extended characters in password
- Enables advanced password policy enforcement
- Allows synchronization of passwords from eDirectory to other systems

Universal Password is managed by the Secure Password Manager (SPM), a component of the NMAS module (nmas.nlm on NetWare).

SPM simplifies the management of password-based authentication schemes across a wide variety of Novell products as well as our partners' products.

The management tools only expose one password and do not expose all of the behind-the-scenes processing for backwards compatibility.

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Secure Password Manager and the other components that manage or make use of Universal Password are installed as part of the NetWare 6.5 or later and eDirectory 8.7.1 installation. However, Universal Password is disabled by default.

Because all APIs for authentication and setting passwords are moving to support Universal Password, all the existing management tools, when run on clients with these new libraries, automatically work with the Universal Password.

The Novell Client supports the Universal Password. It will also continue to support the NDS password for older systems in the network. The Novell Client has the capability of automatically upgrading to the new Password from the NDS password.

Universal Password Security

Because reversible encryption of Universal Password is required for convenient interoperation with other password systems, administrators have to evaluate the costs and benefits of the system.

Using a single copy of the Universal Password stored in eDirectory may be more secure and/or convenient than attempting to manage several different passwords. Novell provides several levels of security to make sure Universal Password is protected while stored in eDirectory.

A Universal Password is protected by three levels of security; tripleDES encryption of the password itself, eDirectory rights, and file system rights.

The Universal Password is encrypted by a tripleDES, user-specific key. Both the Universal Password and the user key are flagged with a hidden attribute that only eDirectory can read.

The user key (3DES) is stored encrypted with the tree key and the tree key is protected by a unique NICI key on each machine. Neither the tree key nor the NICI key is stored within eDirectory, and they are not stored with the data they protect.

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The tree key is present on each machine within a tree, but each tree has a different tree key. So, data encrypted with the tree key can only be recovered on a machine within the same tree.

Thus, while stored, the Universal Password is protected by three layers of encryption.

Each key is also secured via eDirectory rights. Only the administrators with supervisor rights or the users themselves have the rights to change Universal Passwords.

File system rights ensure that only users with the proper rights can access these files.

If Universal Password is deployed in an environment requiring high security, you can take the following precautions:

1. Make sure that the following directories and files are secure:
   - On a NetWare server, secure the following:

     %system32%\novell\nici
   - On a Windows server, secure the following:

     %system32%\novell\nici
     %system32% (where the NICI DLL is installed)
   - On a Linux/Unix server, secure the following:

     /var/novell/nici
     etc/nici.cfg
     /usr/local/lib/libccs2.so (and the NICI shared libraries in the same directory)
   - On LSB-compliant Linux/Unix servers, secure the following:

     /var/novell/nici
     etc/nici.cfg
     /usr/local/lib/libccs2.so (and the NICI shared libraries in the same directory)
     /var/opt/novell/nici
     etc/opt/novell
     /opt/novell/lib

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Consult the documentation for your system for specific details of the location of NICI and eDirectory files.

2. As with any security system, restricting physical access to the server where the keys reside is very important.

Universal Password Deployment Steps

Deploy Universal Password using the following steps:

1. Review the services you currently use and understand their current password limitations.

   Following are some Novell services and the password limitations they have. These limitations are addressed by Universal Password:

   - Novell Client for Windows NT/2000/XP versions prior to 4.9 and Novell Client for Windows 95/98 versions prior to 3.4:
     - **Description.** The Novell Client software for file and print services. Uses the NDS password, which is based on the RSA public/private key system.
     - **Limitations.** The Novell Client provides limited support for passwords with extended characters. Passwords are inaccessible from non-Novell systems. The password is stored in such a way as to prevent extraction, thus disallowing interoperability with simple password.
   - Windows Native Networking (CIFS) in NetWare 6 and NetWare 5.1 (NFAP add-on pack for NetWare 5.1):
     - **Description.** Novell's CIFS server as part of the Native File Access Protocols. It allows Windows clients to access Novell services using the built-in Windows Client Networking Services.

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- **Limitations.** CIFS uses a separately administered password called the simple password. CIFS has no expiration or restriction capabilities for the simple password. CIFS attempts to synchronize with NDS password, but can become unsynchronized.

- Macintosh Native Networking (AFP) in NetWare 6 and NetWare 5.1 (NFAP add-on pack for NetWare 5.1).
  - **Description.** Novell's AFP server as part of the Native File Access Protocols. It allows Macintosh clients to access Novell services using the built-in Macintosh Client Networking Services.
  - **Limitations.** AFP uses a separately administered password called the simple password. AFP has no expiration or restriction capabilities for the simple password. AFP attempts to synchronize with the NDS password, but can become unsynchronized.

For more details on Novell services and password limitations, see “Step 1 - Review the Services You Currently Use and Understand their Current Password Limitations” on page 45 of the *Novell Modular Authentication Services (NMAS) Administration Guide* (nmas.pdf).

You can access the guide from the OES_Docs directory on your *3077 Course CD*.

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2. Identify your need for Universal Password.

If you answer yes to any of the following questions, you should plan to deploy and use Universal Password:

- Do you currently use Native File Access and want to enforce policies such as password expiration and/or password length?
- Do you use or plan to use Native File Access (Windows and/or Macintosh)?
- Do you plan to have international users access Novell Web-based services and/or use the Novell Client for Windows NT/2000/XP or the Novell Client for Windows 95/98 to access Novell file and print services?

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- Do you plan to use Novell Nsure Identity Manager 2, powered by DirXML, with its enhanced password policy and password synchronization capabilities?
- Do you plan to use Nterprise Branch Office 2.0?

3. Make sure your security container is available.

NMAS relies on storage of policies that are global to the eDirectory tree. The eDirectory tree is effectively the security domain. The security policies must be available to all servers in the tree.

NMAS places the authentication policies and login method configuration data in the Security container that is created off of [root] in NetWare 5.1 or later eDirectory trees.

This information must be readily accessible to all servers that are enabled for NMAS. The purpose of the Security container is to hold global policies that relate to security properties such as login, authentication, and key management.

With NMAS, you should create the Security container as a separate partition, and make sure the container is widely replicated. This partition should be replicated as a Read/Write partition only on those servers in your tree that are highly trusted.

Because the Security container contains global policies, be careful about where you place writable replicas, because these servers can modify the overall security policies specified in the eDirectory tree.

In order for users to log in with NMAS, replicas of the User objects must be on the NMAS server.

For additional information, see Novell TID 10091343.

4. Verify that your SDI Domain Key servers are ready for Universal Password by doing the following:

a. Verify that the SDI Domain Key servers meet minimum configuration requirements and have consistent keys for distribution and use by other servers within the tree.

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b. Verify that the SDI Domain Key servers are running NICI 2.4.2 or later. You should have NetWare 6.5 or later or eDirectory 8.7.1 or later installed on your SDI Domain Key servers. However, this is not required. At a minimum, you need to install NICI 2.4.2 or later on these servers.

For more details on SDI Domain Keys, see “Step 4 - Verify your SDI Domain Key servers are ready for Universal Password” on page 47 of the *Novell Modular Authentication Services (NMAS) Administration Guide* (nmas.pdf).

You can access the guide from the OES_Docs directory on your *3077 Course CD*.

---

5. Upgrade at least one server in the replica ring to NetWare 6.5 or later or to eDirectory 8.7.1 or later:

a. Identify the container that holds the User objects of those users who will be using Universal Password.

b. Find the partition that holds that container and the User objects.

c. Identify at least one server that holds a writable replica of the partition.

d. Upgrade that server to NetWare 6.5 or later or to eDirectory 8.7.1 or later.

You do not need to upgrade all servers in your tree in order to enable Universal Password, but you should eventually upgrade all of them.

You should plan to upgrade the servers that hold writable replicas first, followed by those with read-only replicas or no replicas. This allows Universal Password support for services on all those servers.

6. Check the container for SDI Key consistency.

Check to ensure that all instances of cryptographic keys are consistent throughout the tree. The sdidiag utility ensures that each server has the cryptographic keys necessary to securely communicate with the other servers in the tree.

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Do the following:

a. From a NetWare server console, enter **load sdidiag.nlm**.

b. From a Windows server, open a command prompt and run **sdidiag.exe**.

c. Enter the following command

CHECK -v >> sys:system\sdinotes.txt -n *container DN*

For example, if user Bob exists in container USR in the organization Acme within the Acme_Inc tree, you would type .USR.Acme.Acme_Inc. for the container DN.

This reports if there are any key consistency problems among the various servers and the Key Domain servers. The output to the screen displays the results of the CHECK command.

d. If no problems are reported, you are ready to enable Universal Password. Go to Step 7 - Turn on Universal Password.

or

If problems are reported, follow the instructions in the sdinotes.txt file.

In most cases, you will be prompted to run the command **RESYNC -T -n *container DN***.

This command can be repeated whenever NMAS reports -1418 or -1460 errors during authentication with Universal Password.

For more information on sdidiag options and operations, refer to Novell TID 10081773.

7. Turn on Universal Password.

If you are using the Password Management plug-in, do the following:

a. Start **Novell iManager**.

b. Under Passwords, select **Password Policies**.

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c. Start the Password Policy Wizard by selecting **New**.

d. Type a name for the policy and select **Next**.

e. Select **Yes** to enable Universal Password.

f. Complete the rest of the Password Policy Wizard pages.

If you assign a policy to a container that is the root of a partition, the policy assignment is inherited by all users in that partition, including users in subcontainers.

If you assign a policy to a container that is not the root of a partition, the policy assignment is inherited only by users held in that specific container. It is not inherited by users that are held in subcontainers.

If you want the policy to apply to all users below a container that is not a partition root, you must assign the policy to each subcontainer individually.

8. Deploy Novell Client software.

Deploy one of the following prior to enabling Universal Password:

- Novell Client for Windows NT/2000/XP version 4.9
- Novell Client for Windows 95/98 version 3.4
- NMAS Client 2.2 or later

Your Novell Client software does not take advantage of these services until you enable Universal Password (see Step 7).

The Novell Client software automatically starts using the Universal Password when it is enabled. Users will see no differences in the client, except with case-sensitive passwords.

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Backwards Compatibility

Universal Password is designed to supply backwards compatibility to existing services.

By default, passwords changed with this service will automatically be synchronized to the simple and NDS passwords on the User object (unless you specify otherwise using the Password Management plug-in).

This way, NetWare 5.1 and 6 servers running Native File Access protocols for Windows and Apple native workstations will continue to have their passwords function properly.

Novell Client software prior to the Novell Client for Windows NT/2000/XP version 4.9 or the Novell Client for Windows 95/98 version 3.4 will also have their passwords continue to function properly.

The exception to this is the use of international characters in passwords. Because the character translations are different for older clients, the actual values will no longer match.

Customers who have deployed Web-based or LDAP services and who use international passwords have already seen these problems and have been required to change passwords so they do not include international characters.

You should upgrade your servers to NetWare 6.5 and all Novell Client software for full, system-wide international passwords to function properly.

Novell's NetWare Storage Management Services (SMS) infrastructure is used for Novell and third-party backup and restore applications. Additionally, the Novell Server Consolidation utility, Distributed File Services Volume Move, and Server Migration utilities use SMS as their data management infrastructure.

The system passwords used by these Novell and third-party products cannot contain extended characters if they are to function in a mixed environment of NetWare 4, 5, 6, and 6.5 servers.

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However, when all servers are upgraded to NetWare 6.5, extended character passwords can be used.

Refer to Novell TID 10083884 for information on which applications and services are Universal Password-capable, as well as which applications and services are extended character-capable. Many applications and services can use extended characters without Universal Password.

For details on backwards compatibility and password change methods with older services, see “Backwards Compatibility” on page 51 of the *Novell Modular Authentication Services (NMAS) Administration Guide* (nmas.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

Password Management

You can use the following methods to administer Universal Password:

- **iManager.** Administering passwords by using Novell iManager automatically sets the Universal Password to be synchronized to simple and NDS password values for backwards compatibility.

  The NMAS task in iManager does allow for granular management of individual passwords and authentication methods that are installed and configured in the system.

- **ConsoleOne.** The NDS password tab in ConsoleOne run on a NetWare 6.5 server, or on a Windows workstation with the Novell Client for Windows NT/2000/XP version 4.9 or the Novell Client for Windows 95/98 version 3.4 installed, automatically sets the Universal Password and synchronizes for backwards compatibility.

- **NWAdmin32.** The same results should be seen when using NWAdmin32 as with ConsoleOne, although Novell does not plan to test this case.

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- **LDAP.** Changing passwords via LDAP on a NetWare 6.5 server also sets the Universal Password and synchronizes the others for backwards compatibility.
- **Third-Party Applications.** Third-party applications that are written to Novell's Cross Platform Libraries and that perform password management will also set the Universal Password and synchronize the others if the newer libraries are installed on the Novell Client for Windows NT/2000/XP version 4.9 or the Novell Client for Windows 95/98 version 3.4 workstation or NetWare 6.5 server.

If you are using the Password Management plug-in, you can use password policies to specify how Universal Password is synchronized with NDS, simple, and distribution passwords. In addition, an iManager task is provided that lets an administrator set a user's Universal Password.

For details on issues with Universal Password deployment, see “Issues to Watch For” on page 53 of the *Novell Modular Authentication Services (NMAS) Administration Guide* (nmas.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

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Objective 3 Install Novell Samba and Configure Samba Users

To implement Samba on Novell OES servers, you need to know the following:

- How to Install Samba
- How to Prepare Users to Access CIFS or Samba Shares on OES Servers

How to Install Samba

The installation of Samba differs between OES NetWare and OES Linux servers. To understand the differences, you need to know the following:

- How to Install and Configure Samba on OES NetWare
- How to Install and Configure Samba on OES Linux

How to Install and Configure Samba on OES NetWare

Technically speaking, the Samba service is not installed on OES NetWare servers. However, support for the CIFS protocol is part of the default configuration of NSS volumes. The CIFS.NLM is launched by default when the server boots.

The protocols (CIFS, AFP, NFS) that were part of the optional Native File Access Pack (NFAP) on NetWare 6 are now configured and supported by default in OES NetWare.

Any OES NetWare server hosting an NSS volume can be called a CIFS server. NSS volumes on CIFS servers are called CIFS *sharepoints*.

The CIFS context configuration file (cifsctxs.cfg) is configured by default to allow access to users in the same context as the Admin user.

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By default the CIFS server is named *server_name*-W and all NSS volumes mounted on the CIFS server are exported so they can be accessed by SMB-compatible clients.

The default CIFS server behavior on OES NetWare can be changed by modifying the cifsctxs.cfg file. For example, you can modify the cifsctxs.cfg file to allow additional user contexts.

The properties of the CIFS server and its sharepoints can be modified through the CIFS/AFP plug-in in iManager.

You can view the current CIFS server settings at the server console by entering

- **CIFS INFO** (for CIFS server operational information)
- **CIFS SHARE** (to see a list of all the currently mounted CIFS sharepoints)
- **CIFS SHARE *share_name*** (to see the configuration of a specific sharepoint)

For details on CIFS, see "Administrator Tasks for Native File Access for Windows Services" on page 21 of the *Novell Open Enterprise Server: Native File Access Protocols Guide* (native.pdf).

You can access the guide from http://www.novell.com/documentation/oes or from the OES_Docs directory on your *3077 Course CD*.

How to Install and Configure Samba on OES Linux

Samba is installed on an OES Linux server as part of the Novell OES installation pattern.

If you customize your package selection during installation and Samba is not installed, you can use YaST to install the Samba packages later.

Configuration of the Samba service on an OES Linux server is controlled by the /etc/smb.conf file. You can edit the /etc/smb.conf file directly in any text editor (which you will do in Exercise 6-2).

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After making changes directly to this file, you must manually restart the smb daemon for your changes to take effect. You restart the smb daemon from the command line by entering

/etc/init.d/smb restart

or

rcsmb restart

You can also edit the Samba configuration through YaST, using the Samba Client or Samba Server modules. (You will use the Samba Client module in Exercise 6-1.)

When you are done making changes through these modules, YaST writes the changes to the Samba configuration file and restarts the smb daemon.

How to Prepare Users to Access CIFS or Samba Shares on OES Servers

You must complete the following tasks before users can access a CIFS or Samba share on an OES server:

- Samba-Enable Users
- Assign a Universal Password
- Assign eDirectory Object Rights
- Assign File System Rights
- Configure CIFS Contexts

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Samba-Enable Users

The Samba service in Novell OES requires that users be Samba enabled, which provides the following authentication methods:

- **On OES NetWare Servers**. Being Samba enabled gives user objects access to the Samba Default Password Policy which contains a Universal Password configuration option that allows them to access CIFS shares.
- **On OES Linux Servers**. Being Samba enabled gives user objects access to the Samba Default Password Policy and allows LUM-enabled users to authenticate through eDirectory and access Samba shares.

Saying that users need to be Samba enabled implies that at least one OES Linux server is in the tree. The Samba service is not present in the tree unless OES Linux servers have been deployed, which places the Samba Default Password Policy in the tree.

You can use iManager to enable users for LUM and Samba, but the server that you run iManager from must have the LinuxUserManagement and SambaManagement modules installed.

These modules can only be installed for iManager running on an OES Linux server. To access these modules, you must launch iManager from an OES Linux server.

Before you can enable users for Samba, they must already be enabled for Linux:

- For users that are not enabled for Linux, run iManager from an OES Linux server to access the **Linux User Management > Enable Users for Linux** option. You must have a LUM-enabled group object ready to assign these users to.
- For users already enabled for Linux, run iManager from an OES Linux server to access the **Samba Management > Enable Linux User for Samba** option.

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Assign a Universal Password

You assign Universal Passwords by doing the following:

1. Apply a Samba-qualified password policy to a user, group, or container by doing the following:
   a. From iManager, select **Passwords > Password Policies.**

      The Samba Default Password Policy is in the Password Policy list.
   b. From the Password Policies page, select **Edit**.
   c. From the Password Policy drop-down list, select **Configuration Options**.
   d. Review the Configuration Options to make sure that the **Enable Universal Password** and **Allow admin to retrieve passwords** options are selected.
   e. From the drop-down menu, select **Policy Assignment**.
   f. From the Policy Assignment page, assign users, groups, or containers to this password policy; then select **OK**.

      For example, in Exercise 6-1, you assign the container **slc.da** and **marketing.slc.da**.
2. Set a Universal Password for the user.

   After applying a Samba-qualified password policy, all the selected users, groups, or containers are now assigned to this policy.

   When you Samba-enable users in the SLC.DA container, the iManager Samba plug-in will discover this policy assignment.

   After finding the Samba-qualified password policy assignment, the iManager Samba plug-in, looks for the user's Universal Password.

   If a Universal Password has been set, it then becomes this user's Samba password. If a Universal Password has not been set, the iManager Samba plug-in prompts you to set a Universal Password to be used as the Samba password.

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You can enter a password for the user that you are Samba-enabling or you can select the Do not set Universal Password option (not recommended).

If you select the Do not set Universal Password option, users must create their own Universal Passwords by logging in through the Novell Client (or by authenticating to iManager).

The Novell Client supports Universal Passwords and will synchronize the user's eDirectory password to the Universal Password. If a user attempts to use Samba access (to CIFS or Samba shares) without a Universal Password being set, the user's Samba account will be disabled.

You should be aware of the most likely scenarios for setting Universal Passwords in connection with Samba-enabling your users:

- **Creating new users that you want to Samba enable**

  Do the following:

  a. **Assign user's context.** Prior to creating the user, assign the user's context to a Samba-qualified password policy.

  b. **Create the user.** The user's context is already assigned to a Samba-qualified password policy, so the user will be assigned to a Samba-qualified password policy.

     The password you enter when creating the user will be synchronized to the Universal Password because of the Samba-qualified password policy.

  c. **Linux-enable the user.**

  d. **Samba-enable the user.** The iManager Samba plug-in determines that the Universal Password is already set and does not prompt you to enter a separate password.

- **Setting the Universal Password *prior to* Samba-enabling an existing user**

  Do the following:

  a. Assign the user (or the user's group or container) to the Samba-qualified password policy.

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b. Have the user log in to the network with the Novell Client. The Novell Client finds the password policy assignment and discovers that Universal Password is enabled but not yet set.

   The Novell Client automatically sets the Universal Password for this user by synchronizing it with the user's eDirectory password.

c. Linux-enable the user.

d. Samba-enable the user. The iManager Samba plug-in determines that the Universal Password is already set and does not prompt you to enter a separate password.

- **Setting the Universal Password *after* Samba-enabling an existing user**

  Do the following:

  a. Assign the user (or the user's group or container) to the Samba-qualified password policy.

  b. Linux-enable the user.

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c. Samba-enable the user. The iManager Samba plugin determines that the Universal Password is not set and prompts you to enter a separate password. You can choose from the following:.

Option A. Leave the password fields blank and select the Do not set Universal Password option. Afterward have the user log in to the network with the Novell Client, which will synchronize the Universal Password with the user's eDirectory password.

or

Option B. Enter a Universal Password for this user. If you know the user's eDirectory password, you should use the same password. If you do not know the user's eDirectory password, you will have to enter something and let the user know what you entered. The user's eDirectory and Universal Passwords will not be synchronized.

Assign eDirectory Object Rights

When users are attempting to access a CIFS share, they first need to be able to browse the tree for the volume object that represents the share. (This is simply the NSS volume object, such as DA3_EDU.)

By default, all users in the tree have the rights they need to access a volume object. Default rights are read, compare (All Attribute Rights), and browse (Entry Rights).

When preparing Samba users to access a CIFS share, you should confirm that they have these default rights, and that the rights are not blocked by an IRF or an explicit trustee assignment somewhere in the tree.

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Assign File System Rights

With the necessary eDirectory object rights in place, a Samba user will be able to see the CIFS share but will not be able to access any of the directories or files on that share.

By default, users (whether Samba enabled or not) have no rights to the file system on a given volume. As network administrator, you must grant the file system rights you want users to have.

In the initial release of Novell OES, file system rights are managed using Novell Remote Manager (NRM). In future releases, file system management functionality will be added to iManager.

NWAdmin and ConsoleOne are shipped with OES and can be used to manage file system rights, but Novell no longer maintains these tools.

You can use NRM to assign users as trustees and give them the rights they need to directories and files on the CIFS share.

To access the trustee assignment functionality in Novell Remote Manager, do the following:

1. Authenticate to Novell Remote Manager as the **Admin** user.

   The first page you see is the Volume Management page.

2. From the Volumes list, select the **volume** you want to manage.

   The next page shows the entities that exist on the volume you selected. These entities include the root of the volume, and any directories and files that are stored on the volume.

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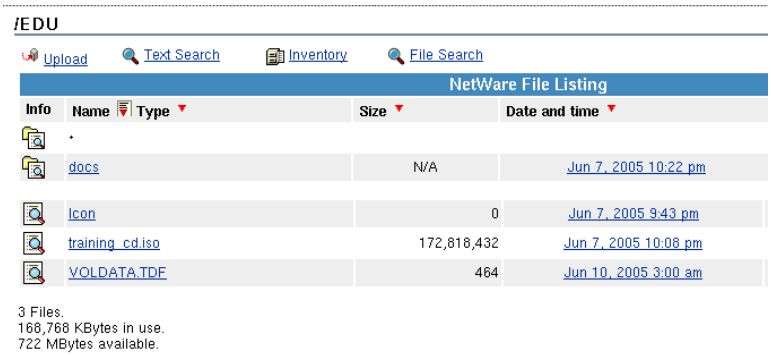
These entities are all listed under the NetWare File Listing heading, as in the following:

Figure 6-1



The entry for the root entity is designated by a dot (.).

3. Configure file system trustee rights to any of these entities, including the root, by selecting the **Info** icon.

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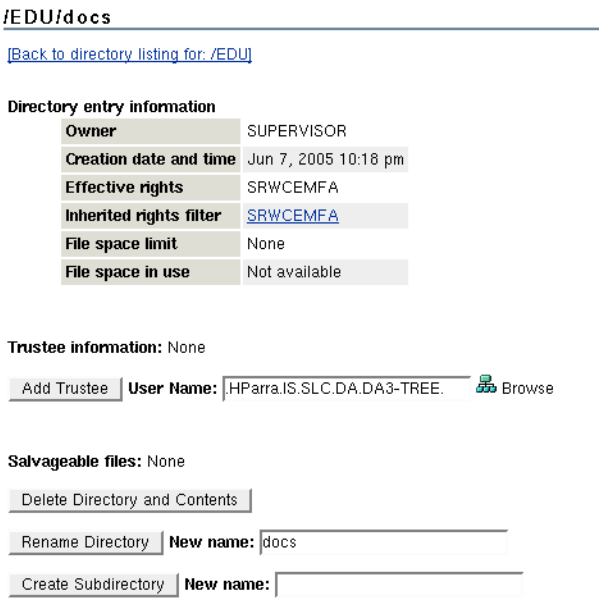
After you select the Info icon, the following page appears with the entity's Directory and Trustee information:

Figure 6-2



4. Under Trustee Information, in the User Name field, enter the ***fully distinguished name*** of the user, group, or container object that you want to assign as trustee.

   This name must include a leading dot, the tree name, and a trailing dot, as shown in Figure 6-2.

5. Once you have the fully distinguished name entered, select **Add Trustee**.

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The next page contains the Trustee Rights table, as in the following:

Figure 6-3

/EDU/docs

Trustee rights	Description
☐ Supervisor	If checked, this indicates all rights.
☑ Read	If checked, this indicates read access to files.
☑ Write	If checked, this indicates write access to files.
☑ Create	If checked, this indicates the ability to create files and subdirectories.
☑ Erase	If checked, this indicates the ability to delete files and subdirectories.
☑ Modify	If checked, this indicates the ability to change files and subdirectories.
☑ File Scan	If checked, this indicates the ability to see files.
☐ Access Control	If checked, this indicates the ability to control access to the file or subdirectory.

OK | Reset

6. From this table, select the desired file system trustee rights; then select **OK**.

   After you have configured file system trustee assignments, the user will only have access to those directories and files that you specified.

Configure CIFS Contexts

Only users from configured CIFS contexts can access a CIFS server. CIFS contexts are controlled by the SYS:\etc\cifsctxs.cfg file. This is a text file that simply contains a list of contexts for users you want to give access to the CIFS server.

By default, cifsctxs.cfg contains an entry with the Admin user's context. For example, the cifsctxs.cfg file on the server you upgraded to OES NetWare in Exercise 1-1 contains the following:

OU=SLC.O=DA

To add another context, you insert a line below the existing line and enter the context, as in the following example:

OU=SLC.O=DA
OU=IS.OU=SLC.O=DA

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After making changes to this file, you have to stop and start the CIFS server before the changes will take effect. You do this by entering the following commands:

CIFSSTOP
CIFSSTRT

The CIFS server can now be accessed by users in the IS.SLC.DA context.

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Objective 4 Describe the Purpose of the Novell Samba Components

The Samba distribution included with Novell OES consists of the following RPMs and configuration files:

- Samba RPM
- smb.conf
- ldap.conf

Samba RPM

OES includes a Novell customized version of the Samba package (novell-samba-2.2.8a . . .).

In compliance with Samba standards, Novell has added the switches **-with-ldapsam** and **-with-ssl** and recompiled the RPM to provide secure LDAP authentication support for Samba users.

smb.conf

In compliance with Linux Standards Base (LSB) requirements, Novell has placed the Samba configuration file (smb.conf) in the /etc/opt/novell/samba directory on the OES server.

The Novell implementation of Samba requires that the smb.conf file contain the following entries:

- **[global].** The following entries need to be configured in the [global] section:
  - **ldap admin dn =.** Specifies the Distinguished Name (DN) that Samba uses for contacting the eDirectory LDAP server to retrieve user account information for users requesting access to Samba shares.

    Example: ldap admin dn = cn=admin,o=novell
  - **ldap ssl =.** Specifies that Samba should use SSL for communications with the LDAP server (eDirectory).

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Secure LDAP requires that this be set to On.

Default: ldap ssl = on

- **ldap port =.** Specifies the port used for secure LDAP communications between Samba and the LDAP server (eDirectory).

  This value can be changed if your network uses a different port for secure LDAP communications.

  Default: ldap port = 636

- **ldap server =.** Specifies the LDAP server's hostname. Either the full DNS name or the IP address can be used.

  Example: ldap server = OES.provo.novell.com

  Default: ldap server = *i.i.i.i* (where *i.i.i.i* = the IP address of the eDirectory server)

- **security =.** This specifies the security mode. The value must be set to **user**. For more information, see www.samba.org.

  Default (required): security = user

- **encrypt passwords =.** This specifies that passwords received from Windows clients will be encrypted. This value must be set to **yes**. For more information, see www.samba.org.

  Default (required): encrypt passwords = yes

- **workgroup =.** This specifies the Windows workgroup that the Samba server will either join (if it exists) or effectively create (if the name is new).

  Example: workgroup = mygroup

  Default: workgroup = workgroup

- **netbios name =.** This sets the netBIOS name by which a Samba server is known and advertised. If Samba is installed for the first time by OES, Novell appends -W to the host name for this entry.

  This is necessary to prevent a conflict with NCP on Linux, which uses the host name.

  Example: netbios name = myhost-W

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- **[homes].** The following are entries that need to be configured in the [homes] section:
  - **comment =.** This specifies the name that appears after the Samba server name in Network Neighborhood on the Windows client.

    If this and the following two entries are set as specified, there is no need to specify individual shares for users' home directories.

    Default: comment = Home Directories
  - **browseable =.** This specifies whether all the home directories appear in Network Neighborhood.

    Default: browseable = no
  - **writable =.** This specifies whether users can create and modify files.

    Default: writable = yes

ldap.conf

The ldap.conf file is found in the /etc/opt/novell/openldap directory on the OES Linux server.

If you install the OES Linux server into an existing tree, you must specify a trusted root certificate during installation if you want to use SSL. The ldap.conf file on your OES Linux server will then have the following certificate-related entries:

```
TLS_CACERT /etc/ssl/certname.cert
```

```
TLS_REQCERT demand
```

If you are installing a new directory tree, the ldap.conf file will have the following entry:

```
TLS_REQCERT allow
```

For more information on the ldap.conf file, see the ldap.conf man page.

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Exercise 6-1 Access CIFS Shares on the DA2 NetWare Server

You are now ready to test the CIFS protocol by creating and accessing CIFS shares on your DA2 NetWare server.

In the first part of this exercise, you lay the groundwork for providing CIFS access by performing steps that serve two purposes.

- The first purpose for performing the steps in the first few parts of this exercise is to configure Samba and Linux User Management so users can access Samba shares on an OES Linux server.

  However, you do not access Samba shares on an OES Linux server in this exercise, but will do so in Exercise 6-2.

- The second purpose for performing the steps in the first few parts of this exercise is to add a password policy to your tree that allows you to enable Universal Password for your users.

  The Samba Default Password Policy gets added to your tree when you install Novell Samba on an OES Linux server in the tree.

  The Samba Default Password Policy contains a Universal Password configuration option that you use to allow your users to access CIFS shares on the OES NetWare server.

The Samba Default Password Policy is not the only way to provide the Universal Password configuration option. You can create password policies through the Password Policy Wizard in iManager that enable Universal Password.

The last part of this exercise allows you to verify that your configuration is working properly by accessing CIFS shares from a Windows Workstation and from a SUSE Linux Enterprise Desktop (SLED) 10 workstation.

Exercise 6-1 Access CIFS Shares on the DA2 NetWare Server is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 6-2.

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Exercise 6-2 Access Samba Shares on the DA1 Linux Server

In Exercise 6-1, you completed many of the steps required for providing your users with access to Samba shares on an OES Linux server, including the following:

- Installing Novell Samba on you OES Linux server
- Enabling your users for LUM and Samba
- Configuring a password policy that enables Universal Password
- Making sure your users have Universal Passwords set

With these components in place, you are now ready to create Samba shares on your DA1 Linux server and access those shares from your Windows and SLED 10 workstations.

Exercise 6-2 Access Samba Shares on the DA1 Linux Server is in your *Integrating Novell Open Enterprise Server for Linux Workbook* on page 6-12.

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Summary

Objective	Summary
1. Describe the Purpose of Novell Samba	Samba in Novell OES is a file access service that lets you use the Server Message Block (SMB) networking protocol with Linux computers and other platforms.
2. Describe the Purpose and Architecture of Universal Password	Universal Password is a way to simplify the integration and management of different password and authentication systems into a coherent network.
3. Install Novell Samba and Configure Samba Users	To implement Samba on Novell OES servers, you need to know the following: ■ How to Install Samba ■ How to Prepare Users to Access CIFS or Samba Shares on OES Servers
4. Describe the Purpose of the Novell Samba Components	The Samba distribution included with Novell OES consists of the following RPMs and configuration files: ■ Samba RPM ■ smb.conf ■ ldap.conf

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